ERIC Document Resume	See Instruction Sheet	DATE OF RESUME 7/30/65	DATE RECEIVED

A. PUBLICATION DATA

1. ERIC NUMBER	2. ORIGINATOR CONTROL NO(S).	3. IDENTIFICATION NO.
ED001321	N.A.	N.A.

4. AUTHOR(S): Fresno County Schools

5. TITLE OF DOCUMENT ABSTRACTED: Grade Two SCIENCE

6. PUBLICATION TITLE: N.A.

7. EDITOR(S): N.A.

8. PLACE OF ORIGIN
ORG. Fresno County Board of Education
ST.
CITY, STATE Fresno, California
TELE. EXT.
INST/LOC CODE

9. PUBLISHER OR SOURCE: Fresno County Schools, Board of Education, Fresno, California

10. VOL.	11. PAGES	12. MO./YR.	13. TOTAL PP.
N.A.	N.A.	9/64	117

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TYPE OF REPORT
PROPOSAL ☐
IN-PROGRESS ☐
FINAL ☒
FOLLOW-UP ☐

OTHER ERIC REFERENCES:

ERIC SATELLITE CODE

B. INDEXING DATA

14. SUBJECT AREA

15. TYPE OF ENDEAVOR: curriculum guide

16. INDEXING TERMS (6-12)

student experiences	elementary schools	grade two		
science curriculum	problem solving	science displays		
science experiments	audio-visual			

17. ABSTRACT (MAX. 250 WORDS)

In elementary science education, concepts are built from experience, not memorized from printed material. Teachers should be alert at all times to set up or call attention to situations providing opportunities for the use of problem-solving techniques. The types of activities that will promote and stimulate problem-solving situations and help to develop scientific attitudes include: discussion, experimentation, excursions, use of audio-visual materials, allowing creative expression, observation, and use of resource people. Rooms should display various science materials, including a nature table.

The units used in grade two are: magnetism and electricity, meteorology, heat, astronomy, and light. Each unit includes a vocabulary, a list of equipment supplies, problems and concepts, resources, and suggested activities. For example, to demonstrate the concept that friction is a source of heat, the teacher should have the children rub erasers quickly on the desk and then feel the erasers.

ERIC No.

18. SOURCE OF ABSTRACT

C. FUNDING DATA

19. SUPPORTING ORGANIZATION

20. DIVISION OR DEPT.

21. CONTRACT NO.

PROJECT NO.

22. TOTAL COST OF PROJECT

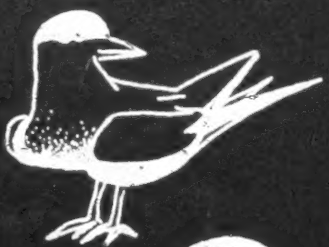
23. DURATION OR PROJECT

U.S. Department of Health, Education, and Welfare
Office of Education

ERIC Form 1

10-0
1964

Grade Two



SCIENCE

ED001321

experimentation

observation

Return to
CURRICULUM LABORATORY
721 Capitol Avenue, Room 455
Sacramento 14, California

Fresno County Schools

Harold L. Coles, Sup't.

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FOREWORD

This Guide has been cooperatively prepared by personnel from school districts in Fresno County and by staff members in the Office of the County Superintendent of Schools. The primary purpose for its publication is to provide a source of help for teachers in implementing the Course of Study requirements for science.

The suggestions contained herein are not to be considered all-inclusive, or final. They are simply a record compiled by teachers who taught a unit but who may wish to alter it some way when they teach it again.

Teachers are urged to keep the unit up-to-date by consulting A.V. catalogs and the library for the latest instructional aids. You are urged to call upon staff members from this office who will be most happy to assist you in improving the science program in any way possible and will in turn appreciate constructive ideas which you may offer.

A limited number of copies of this unit have been produced so that revision can be made economically incorporating any modifications which may arise from use in the classroom.

This publication has been produced with knowledge and approval of the Fresno County Board of Education.

Harold L. Coles
HAROLD L. COLES
Superintendent of Schools
Fresno County

HLC:nb

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California State Department of Education

ACKNOWLEDGMENT

Recognition and sincere appreciation is expressed to those teachers who devoted many hours of effort both in and outside of the classroom to the preparation of this Guide.

Preparation of the Guide was greatly aided by the cooperation of Governing Boards and Administrators who provided two days of released time for the teachers who worked on the project.

Teachers, districts and administrators are as follows:

Teacher	District	Administrator
Lorraine Baird	Fairmont	Glen Corwin
Joy Bircher	Caruthers	Harry Anderson
Vanessa Chadwell	Indianola	George Clemons
Hazel Henshaw	Lone Star	Paul Reall
Barbara Kiseloff	Sun-Empire	Delbert Anderson
Katye Randol	Cantua	Roy Kinney

Members of the County Superintendent's Staff who also served are: Stewart Brown, Chairman of Science Curriculum Committee, Edna Cox, Nita Himes, Harold Walton, Virginia Quesenberry, and Ben H. Watkins.

* * * *

SCIENCE COURSE OF STUDY

ALLOCATION OF SCIENCE AREAS FOR EMPHASIS

	GRADES							
AREA OF STUDY	1	2	3	4	5	6	7	8
Animals	X		X		X		X	
Astronomy		X		X		X		X
Chemistry			X	X		X		X
Conservation					X			X
Geology	X		X		X		X	
Heat		X	X			X	X	
Light		X				X	X	
Machines & Engines		X		X	X			X
Magnetism & Electricity		X	X		X	X		X
Meteorology		X		X		X	X	
Plants	X		X		X			X
Sound	X		X			X	X	
Water				X				

The division of responsibility for science instruction is shown on this chart. Such a division decreases the number of topics to be treated at any given grade level with a more thorough study made possible. If it is faithfully followed, it will also prevent gaps in science experiences.

If a particular topic was not studied during the year preceding, then the teacher must develop the concepts which otherwise would have been developed in the lower grade. Only in the seventh grade does a teacher ever have to go into a topic as created at a higher grade level.

In addition to the topics assigned to each grade, the teacher should feel free to give adequate treatment to any problems presented by children themselves as a "current" or "on the spot" science interest.

Generally speaking, the concepts to be developed in any area at any grade level will be found in the state adopted science texts for that grade or those used in a lower grade as mentioned in the second paragraph above. The fourth grade unit on water was developed from different science texts all of which are available as a Science Text Set for fourth grade. The seventh grade will need to use eighth grade references on topics which are studied for the last time in the seventh grade.* As a teacher in any grade, you may request a Science Text Set from the library which will aid in the development of concepts. You are also urged to use the unit materials from the library and the instructional aids from the Audio-Visual Department.

*See chart above.

The "HOW" of Teaching Science in the Elementary School

...concepts are built from experiences and not memorized from printed materials.

...the teacher must not tell pupils the answers
...the teacher's role is to establish the problem
...the teacher must let pupils make some mistakes

...teachers must be alert at all times and consciously attempt to set up or call attention to situations providing problem-solving techniques.

...experiments that do not work the first time often are the most productive learning situations.

...the following types of activities will promote and stimulate problem-solving situations and help develop scientific attitudes.

...discussion

---will help to answer problems
---will help clarify the problem or concept
---will help pupils realize that explanations are not always reliable--additional sources of information are needed
---will give pupils opportunities to share experiences about the problem or concept
---will encourage in thinking

...experiment

---will help clarify problems
---will help in finding solutions to problems
---will alleviate superstitions
---will need several performances to prove that experiment is reliable
---will be accompanied by reading and discussion
---should not be mere demonstrations on the part of the teacher or one pupil
---equipment should be left in the room for pupil use for several days
---children should be able to apply conclusions to other situations

*the application of the experiment and the method used in performing it are just as valuable as knowledge gained.

...excursion

---many opportunities are in the out-of-doors
---children should know "why" they are going
---there should be careful group planning
---extends child's interests, knowledge and understandings
---child grows in ability to observe and see
---child grows in learning to report accurately observations
---observations should be checked against authorities

...reading

---occupies a large place in science
---may develop leads for investigation
---orients pupil to the concept
---gives pupil illustrations to check for accuracy and information
---gives reliable information to check with observations
---science material may be the only kind of material some children will read

The "HOW" of Teaching Science in the Elementary School (Cont'd)

...audio-visual materials

- ---is another way to help solve a problem
- ---should not constitute the whole program
- ---there should be preparation for use and follow-up
- ---the teacher may need to use the material several times

*types of audio-visual materials that can be used

- ---realia--what one can see with the eye
- ---pictures
- ---collected specimens
- ---phonograph recordings
- ---live objects--plant or animal
- ---objects--rocks, minerals
- ---slides
- ---filmstrips and films

...construction

- ---individual and group projects do not constitute a science program
- ---one way a child learns is by doing
- ---children grow by manipulating and constructing when it has a purpose and extends an interest

...creative expression

- ---the idea expressed and the science concepts should be important, not the product itself

...observing

- ---first hand experiences are the most valuable
- ---helps to determine how things look
- ---helps to determine how things act
- ---helps us to be aware of cause and effect
- ---helps us to realize change and interdependence in plants and animals
- ---helps us to interpret things that we read
- ---helps us to realize how man controls his environment (soil, water, etc.)

...collecting

- ---satisfies a natural curiosity of children
- ---be sure the collection is helping to solve a problem
- ---plan collections carefully so they have meaning
- ---collections do not constitute the science program

...resource people

- ---can give reliable information about the local area
- ---help to stimulate interest

*resource person should be able to talk on the level of the group

The "HOW" of Teaching Science in the Elementary School (Cont'd)

...evaluation

- ---activities designed for evaluating are extremely useful as learning activities
- ---achievement should always be interpreted in relation to the device used
- ---teachers should also place a value on the experiences she has offered the children

ARRANGING THE CLASSROOM FOR SCIENCE INTERESTS

I. The Nature Table:

   A. What type of table should be used for the display?

      1. Any regular classroom table.

      2. Any space designated as "display space" in the room planning. (ledge, top of low cupboard, etc.)

      3. A round table. (ideal because of accessibility)

   B. Where should the display table be placed?

      1. The display table should be in any central, easily-accessible place.

   C. When should the display table be used?

      1. Use the table upon arrival of the children before school formally opens.

      2. Use the table during work time.

      3. Use the table after clean-up time -- if time permits.

   D. How long should science materials be displayed?

      1. Some displays should be permanent.

         a. Fish.

         b. Turtles.

         c. Insect homes.

      2. Other displays should be changed to match the seasons and as often as the children's interests dictate.

II. Ways of Displaying Science Materials:

   A. Arrange the display on colored paper.

   B. Arrange on small trays of various sizes.

   C. Arrange on paper plates. (various sized plates may be painted by the children.)

   D. Use cardboard boxes with cellophane inserted as a window in the box lid.

   E. Use test tubes, or alka-seltzer bottles, etc., in a test tube rack to display wild or garden flowers, weeds, etc.

   F. Use corrugated paper rolled tightly as holders to display feathers, weeds, etc.

Arranging the Classroom for Science Interests (Cont'd)

G. Use rocks in a bowl of water to grow bulbs.

H. Use glass bowl for observing seed germination, planting seeds close to the glass.

I. Display science books and pictures on stands with objects on display.

J. Use an aquarium for displaying fish and marine life.

K. Use a terrarium for displaying plants and small animals.

L. Use small plastic bags to display seeds and leaves.

M. Cages for visiting pets may be placed near the science center. (call about restrictions from County Health Department)

N. An insect house may be placed in the science display center.

SCIENCE GUIDE

Unit Magnetism & Electricity

Grade Two

Fresno County Schools

HAROLD L. COLES, Superintendent

September, 1964

VOCABULARY

attract

charge

compass

conductor

current

dry cell

electric circuits

electricity

filings

insulator

magnet

north pole

permanent

repel

south pole

static electricity

APPARATUS, EQUIPMENT AND SUPPLIES

bar magnets

horseshoe magnets

bottle half-filled with iron filings

needles

paper clips, pins, nails (assortment of objects which do, and others which do not, respond to magnetism)

toys which use magnets

insulated copper wire

dry cell battery

compass

jackknife

iron bar or rod, small

steel balls from worn-out bearing

small pieces of tin, 1" x 3" or 4"

screws

The A-V Department of Fresno County Schools has the following:

cylindrical magnets

bar magnets

horseshoe magnets

study prints: Magnets

film: Electricity All About Us

filmstrips:

"Electricity and Magnets"

"Magnetism and Electricity"

"Magnets"

INTRODUCING THE UNIT

To introduce the unit on Magnetism and Electricity, we arranged, on the science table, study prints secured from the Audio-Visual Department of Fresno County Schools.

Along with the study prints, there were magnets of different shapes and sizes, and objects for children to explore the pulling power of magnets.

On the second day, we showed the filmstrip, "Magnetism and Electricity." At its completion, we had a discussion period, evaluating what we had learned from it. We found that many were eager to learn more.

PROBLEMS AND CONCEPTS	RESOURCES
What do magnets attract?	
Magnets attract iron and steel. (Other substances, too, such as cobalt, but iron and steel are the important ones, for Primary Grades.)	Parker, Magnets, p. 4 Frasier, Seeing New Things, pp. 120, 121, 125 Thurber, Exploring Science, p. 125 Pine, Magnets and How to Use Them, pp. 10, 11
Do all magnets look alike?	
Magnets vary in size and shape.	Pine, Magnets and How to Use Them, p. 19
Magnets are usually in one of these shapes - bar, "U", or horseshoe.	
Each magnet has two poles, North and South.	Podendorf, The True Book of Magnets and Electricity, p. 14
(If a bar magnet were broken, each piece of it would then have a North and a South pole.)	
How do the poles of a magnet react toward each other?	
Opposite poles attract. The South pole of one magnet will pull toward the North pole of another.	Podendorf, The True Book of Magnets and Electricity, p. 16 Yates, Boys' Book of Magnetism, p. 14
A magnet's pull is strongest at its poles.	
A. Because the strong parts, or ends are near each other in a horseshoe or "U" magnet, these magnets have good lifting power.	Parker, Magnets, p. 10 Feravolo, Junior Science Book of Magnets, p. 18 Pine, Magnets and How to Use Them, pp. 17-18
Not all magnets are permanent or "all-time" magnets.	
A. One such is a big machine used in steel mills to move big loads of iron.	Parker, Magnets, pp. 3, 26

ACTIVITIES

Place a variety of objects in a box on the science table -- pins, nails, pencil, paper clips, gold ring, brass paper fasteners, etc. Let the children experiment, to learn which objects can be picked up by the magnet.

Ask some children to bring toys which use magnets.

Let children see the usual markings, "N" and "S" on a pair of bar magnets.

Explain that the "U" or horseshoe magnets are bent bar magnets, and that each magnet has a North and a South pole.

Children may discover, through experimentation, the principle that opposite poles attract and like poles repel.

Hang a bar magnet up by a string, so that it can swing freely. Let children experiment.

Tape a thread securely around a magnetized needle. Hold or hang it up so that it swings freely. The ends point north and south.

A pair of bar magnets proves intriguing for children -- this attract-and-repel feature is so plainly demonstrated with them.

Experiment with various objects and different magnets to learn which parts of the magnets will lift the greater number of objects, or will lift the heaviest weights.

Experiment to learn if a horseshoe or "U" magnet is able to pick up as many objects with its curved area as with the poles.

Lay a piece of paper over a magnet. Shake iron filings onto the paper, and watch them become arranged into the pattern of the magnet.

Iron filings should not be allowed to come in direct contact with a magnet since they are difficult to remove.

PROBLEMS AND CONCEPTS	RESOURCES
The magnetism of this kind of apparatus can be turned on and off.	
A. The power for these machines is electrical current, so we call this kind of magnet an electromagnet. It takes a current of electricity flowing through a coil of wire to the magnet, to cause it to be able to lift iron or steel. When this power is turned off, it is no longer a magnet.	Podendorf, Magnets and Electricity, p. 27 Parker, Magnets, p. 14
B. Pure iron will not make a permanent magnet. Iron cannot keep its magnetism.	
Magnets can exert pushing or pulling force through some materials.	
A. A magnet can attract metals through glass or paper - even through several thicknesses of paper.	Parker, Magnets, p. 11 Frasier, Seeing New Things, pp. 119, 122-125 Arey, Science Experiments for Elementary Schools
B. A magnet can attract or repel an object without touching it.	Leaf, Science Can Be Fun, p. 38
A suspended magnet points north and south.	
This demonstrates a compass.	Pine, Magnets and How to Use Them, pp. 24-33
A compass needle is a permanent bar magnet. It is suspended so that it may turn freely and points approximately north.	Feravola, Junior Science Book of Magnets, p. 31
A compass can be made by magnetizing a large steel needle.	Podendorf, Magnets and Electricity, p. 18 Parker, Magnets, pp. 23-24 World Book "Science Project" Vol. 13, p. 52b
A magnet can be used to make another magnet.	
A bar magnet can be made from an ordinary iron bar.	Leaf, Science Can Be Fun, p. 39

ACTIVITIES

Ask the children if they have ever seen big loads of iron scraps, etc., being lifted with such machinery at a car wrecking yard, or any such place.

Discuss commercial use of electromagnetism and ask the children to find pictures, showing this use, in the reference books listed.

Maneuver "boats," nails, or such objects about, by moving a magnet under glass, thin wood, or paper, on which these objects lie.

Let children place a paper clip or like object on top of a piece of cloth or paper; then maneuver the magnet underneath the material to be moved. The material can then be picked up with the steel object.

A pupil may pick up a nail with the magnet, then touch smaller nails or other objects with the nail, while it is still on the magnet. He may see that the magnet can work through the large nail, and then, when the latter object is removed from the magnet, the smaller objects are no longer attracted to the large nail.

Make a compass by magnetizing a needle.

A. Rub the large steel needle slowly from the middle to the pointed end, with a bar magnet; being sure to use the same end of the magnet. Rub slowly, and in only one direction, about thirty times. Lift the magnet away from the needle after each stroke.

B. Now insert the magnetized needle into a cork, (or attach it with sealing wax) horizontally. Place the cork in a pan of water. The needle will point north and south.

C. This magnetized needle becomes a permanent magnet.

Make a small paper sailboat and put a magnetized needle on the bottom. Move this about on a pan of water, using another magnet.

To make a bar magnet, place an iron rod or bar so that it is in line with a compass, the bar or rod pointing north and south. Rest the north end of the bar on the table, and slant the other end upward, above the compass. Hit the south end of the bar sharply many times with a hammer. This will magnetize the bar, and small objects may be picked up with it.

PROBLEMS AND CONCEPTS	RESOURCES
Static electricity can be made in the classroom.	
This kind of electricity cannot move from place to place along wires. "Static" means "not moving."	Feravolo, *Junior Science Book of Electricity*, pp. 5, 6
Static electricity can be made by rubbing objects together.	Podendorf, *The True Book of Magnets and Electricity*, pp. 42, 43 Freeman, *The Story of Electricity*, pp. 5, 6
Static electricity can even "bend" a stream of water.	Feravolo, *Junior Science Book of Electricity*, pp. 10, 11
This kind of electricity cannot stay long in a comb or such object.	Freeman, *The Story of Electricity*, pp. 16, 17
It may move easily through some things, and not at all through others.	Thorn and Harbeck, *Let's Look Around*, pp. 135-140 Leaf, *Science Can Be Fun*, pp. 40-41
Why can we not use static electricity in our homes to run appliances?	
Since it is static, it cannot travel through the wires that come into our homes for our power to run the appliances.	Freeman, *The Story of Electricity*
For operating appliances, we use a different kind of electricity.	
This is known as "current" electricity.	
A metal that allows a charge of electricity to move through it easily is called a "good conductor."	Podendorf, *The True Book of Magnets and Electricity*, pp. 37-39
Copper wire is a good conductor. It is used most commonly to bring electrical power to our homes.	
Electricity comes to our homes on wires from a central power plant.	

ACTIVITIES

To show static electricity, rub a hard rubber comb through the hair a few times, then hold the comb near a sheet of paper.

Let children rub two pieces of wool flannel together vigorously in a metal waste basket, or other such container. They may hear the crackling of static electricity.

Suggest to them that they comb their hair in the dark before a mirror, and watch for a spark.

Ask them if they ever experienced a shock from walking on a thick carpet, then touching metal, such as a door knob, or from touching the handle of a car door, after sliding across the car seat.

To "bend" a stream of water, rub a comb briskly with a woolen cloth. Now hold one edge of the comb near a slow stream of water from a faucet. The comb must not touch the water.

Still another experiment with a comb; this to be used preferably on a cold dry day. Rub a comb quickly through the hair several times, then touch the dry palm of the hand lightly with the comb. One may be able to both hear and feel the effects of the charge of electricity that the comb has received.

For other experiments, see pages 8 and 9 of The Junior Science Book of Electricity by Feravolo.

It may be possible to take children out to see the different sizes of wires used. It may be explained to them that the large wires carry high currents, and that the smaller wires carry the reduced current to the homes. (This could be compared with the large irrigation canals and the smaller branch irrigation ditches.)

Children should be warned that there are other conductors of electricity, and that water is a dangerous one. They should be warned about touching an electric switch while standing on a damp floor, or while hands are wet.

Let children remove insulation from a piece of lamp cord and find what kind of wire is used as conductor.

PROBLEMS AND CONCEPTS	RESOURCES
If it is to be carried far, the wires are thick and heavy, and are carried on tall towers.	
Many materials, such as rubber, cloth, paper, and wood, are poor carriers or conductors of electricity.	Podendorf, Magnets and Electricity, pp. 36-41
These are not metals, and may be used as insulators.	
Insulation is any material which is used to keep electricity in its proper path.	Feravola, Junior Science Book of Electricity, pp. 12-15
All electrical wiring is wrapped with some kind of insulation, to make it possible to carry electrical power without it getting out of its path and causing a fire or shocks.	Notkin, The How and Why of Electricity, p. 36
Electricity always follows the easiest path.	
Electricity can be easily controlled.	
Electricity can be dangerous if not properly handled.	
Electricity can be very useful.	
Electricity gives us heat and light and provides power for machines.	
Homes and streets are lighted with it.	
It furnishes power for our radio, television, cooling and heating appliances, and many other needs in the home.	Feravolo, Junior Science Book of Electricity, pp. 1-4
In factories, it runs machinery.	Thorn and Harbeck, Let's Look Around, p. 60
It helps send rockets into outer space.	Frasier, Seeing New Things, pp. 217-219
It lifts elevators in tall buildings, and drawbridges over deep rivers.	Thurber, Exploring Science, pp. 100-102

ACTIVITIES

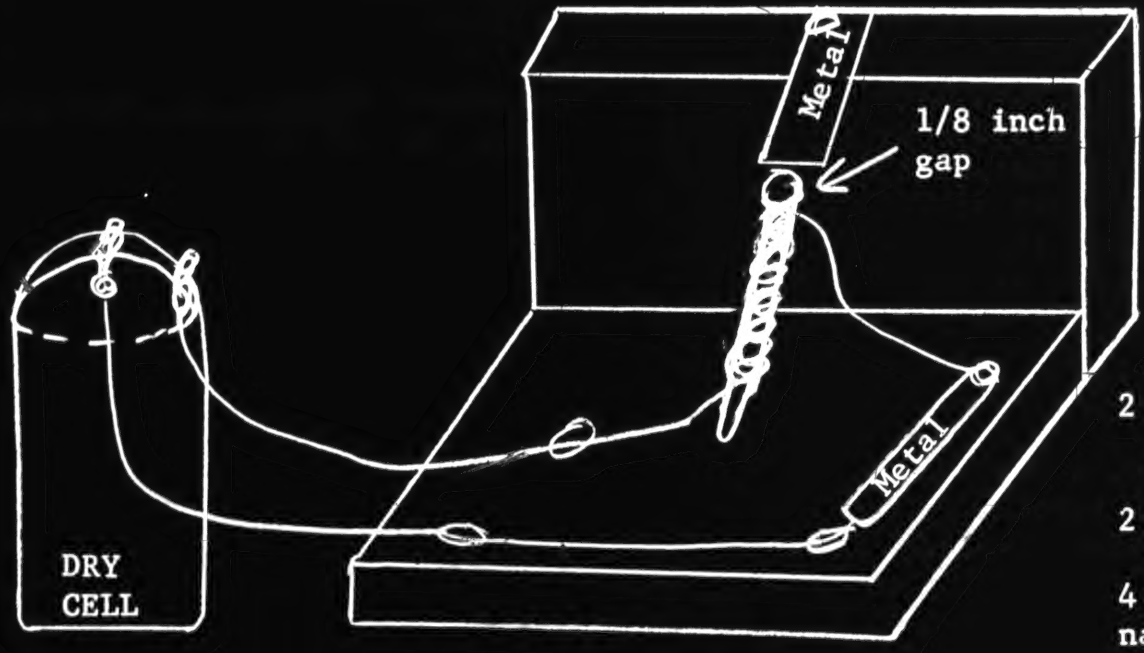
Children may enjoy making booklets, either drawing or pasting in pictures showing the different ways in which current electricity is used in their homes.

Another chart or booklet might depict the many ways they can show uses of dry cell batteries.

Art periods may be used to let children draw outdoor scenes, including the tall towers carrying heavy wires and the smaller wires coming into the home.

Children may enjoy making a scrapbook showing ways that industry uses electricity to power machines.

PROBLEMS AND CONCEPTS	RESOURCES
Trains, cars, buses, and airplanes use electrical power.	Bond et al, Thinking About Science, pp. 138-141
Doctors use it to test your heart and to make X-ray photographs.	Freeman, Fun With Science, p. 47
Printing presses and book-folding machinery use electricity.	
For many big jobs, electromagnets are used.	Feravolo, Junior Science Book of Magnets, pp. 49-51
They get their power from electricity.	
We can make small electromagnets using a dry cell battery.	Feravolo, Junior Science Book of Electricity, pp. 50-52
The telegraph is used to send many messages to distant places.	
The telegraph wires are stretched over mountains and valleys from city to city.	Feravolo, Junior Science Book of Electricity, pp. 53-59
We can make a small telegraph set to give us an idea of how a real one works.	



2 pieces of wood for back and base,
2 pieces of thin metal,
4 screws,
nail to drive into base,
dry cell battery,
insulated copper wire

Make a telegraph set that will work.

Nail the two pieces of wood together at back of base.

Nail one piece of metal to the top edge of the backboard.

Drive the long nail into the bottom board so that the strip of metal clears the top of it by about 1/8 inch.

Fasten the other strip of metal to the bottom board, as shown. Under the unattached end of the tin, put another screw. Wind about two feet or more of wire around the nail. Scrape insulation from the ends of the wire, where it will be attached to the battery terminals and the two screws.

Now, when you press the bottom metal piece, a circuit of electricity will be made in the wire. This will turn the coil of wire around the nail into an electromagnet. This will attract the top metal piece, which will then snap down with a clicking sound.

In the Morse code, a dot is two clicks close together; a dash is two clicks spaced farther apart.

Some of the children may be interested in learning a few words in the Morse code.

PROBLEMS AND CONCEPTS	RESOURCES
There are three kinds of electric circuits.	
A. A complete circuit.	
An electromagnet must have a complete circuit to work. The electricity must be able to go from one post of a dry cell through the wires to the other post of the dry cell.	Podendorf, *Magnets and Electricity*, pp. 29-33
B. A broken circuit.	
A broken wire, a loose connection, or a turned-off switch may cause a broken circuit.	
C. A short circuit.	
If electricity does not travel the path that it should, but jumps to a shorter path, we call it a short circuit. The short circuit may be dangerous.	
What can we do with a dry cell battery?	
There are many, many uses for a dry cell battery.	Thurber, *Exploring Science*, pp. 92-99
As experiments, you can light an electric lamp with one.	
You can ring a doorbell, and light a doll house.	
Flashlights, bicycle lights, hearing aids, portable radios, and some doorbells use dry cell batteries.	
Many toys are powered by these batteries.	Feravolo, *Junior Science Book* of Electricity, p. 51
Dry cell batteries are safe to handle and you can make a small electromagnet with a large nail, a battery, and some wire.	

ACTIVITIES

Complete circuit concept may be made more clear to children if they are asked to form a circle, holding hands, passing a "squeeze" around the circle.

When one pair of hands is dropped, the broken circuit is shown.

Equipment may be set up, using a dry cell battery and a buzzer, light, or bell, to demonstrate the complete circuit.

Bring a flashlight to school and discuss the fact with the children that its battery is unlike the electric current, for it is good for only a limited length of time.

A child may have toys operated by batteries. These may be shared with others during the activity session.

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HLC:nb

SCIENCE GUIDE

Unit Machines and Engines

Grade Two

Fresno County Schools

HAROLD L. COLES, Superintendent

September, 1964

VOCABULARY

ax
axle
ball bearings
bicycle
bolt and nut
chisel
combination
crank
diesel
electricity
engine
flagpole
friction
fulcrum
gasoline
gears
hammer
hatchet
inclined plane
jack
knife
lever
machine
motor
muscle
nail
needle
nutcracker
oil
plane
pulley
ramp
roller
rubbing
saw
scissors
screw
slope
surface
wedge
wheel
windmill
work

APPARATUS, EQUIPMENT, AND SUPPLIES

Children may bring tools and objects which are examples of one or more of the six kinds of simple machines.

Wheels and Axles

toys with wheels
roller skate
doorknob
egg beater

Pulley

Any size or combination with which to experiment

Inclined Plane

Teacher can obtain 5 ft. board and 3 ft. board

Screw

piano stool
vise
jack screw
meat grinder
screw type earring
wood screw
screw top jars and lids
c-clamp
bolt and nut

Wedge

ax
saw
can opener
chisel
plane
hatchet
scissors
knife
needle
pruning shears
nail

Lever

claw hammer
crowbar

These objects may be used in experiments.

Wheels

bicycle
pencil sharpener
egg beater
wagon

Pulley

Any size or combination of pulleys with which to experiment

Inclined Plane

5 ft. board
3 ft. board
playground slide
roller skate
string

Screw

piano stool
wood screw
soft board
screw driver
4" x 4" paper cut diagonally
pencil

Wedge

saw
soft board
knife
knife sharpener
hammer and nails

Lever

yardstick
book end
2 books tied together
loaf of unsliced bread with string
5 ft. board
small wooden box
playground seesaw

Friction

bicycle
sandpaper
block of wood

PROBLEMS AND CONCEPTS

PROBLEMS

1. What is a machine?
2. How do machines help us to do work?
3. What is friction?
   How does friction affect the work of machines?
4. How can we use machines safely?
5. How do we care for machines?
6. What is an engine?

CONCEPTS

1. A machine is a tool or device that helps people to do work.
2. There are six kinds of simple machines. These are the wheel and axle, the pulley, the inclined plane, the screw, the wedge, and the lever.

   Wheel and Axle

   a. Wheels help in moving people and things.

   b. It is easier to push or pull a load on wheels than it is to drag it along the ground.

   c. Wheels must have axles in order to make work easier. Examples are doorknobs, screwdrivers, auto steering wheels, grindstones, wagons, bicycles, pencil sharpeners, etc.

   d. A wheel with teeth or cogs can move another wheel with cogs. The egg beater and the bicycle use this idea. Cogwheels that engage each other are called gears.

RESOURCES

BOOKS

Teacher

- Blough, Elementary School Science and How To Teach It
- Craig, Science For The Elementary School Teacher
- Lewis, The Teaching of Science In The Elementary School
- Notkin, How and Why Wonder Book of Machines
- Parker, Science Experiences

Texts - Pupil

- Baker, Around the Corner
- Beauchamp, Science is Exploring
- Craig, Science Near You
- Craig, Science Around You
- Dowling, The New Seeing Why
- Thurber, Exploring Science - Three
- Machines, Fresno County Schools Science Workshop, September, 1958

Enrichment - Pupil

- Elting, Machines at Work
- Hobin, What Does It Do and How Does It Work?
- Leavitt, The True Book of Tools for Building
- Pine, Friction All Around

ACTIVITIES

The teacher can introduce the unit by making a bulletin board display of "Machines." Pictures of various machines could be cut from magazines. Include simple machines such as the wheel, screw or wedge. Pictures of skates, egg beaters, bolts and screws should arouse the children's curiosity as to why these are included. Discuss what machines are and what they do.

"Machines Do Work" or "Machines" are excellent films to introduce the unit.

Make a display. Have the children bring various machines from home. They may include toys, machines or tools from the workshop or from the kitchen. Group and label items to show which of the six simple machines are involved. Some items will involve combinations of machines so that the children may have to decide under which label they would like to include the item.

Discuss different kinds of machines that travel. Make a border or bulletin board display of drawings of machines that travel. Cars, trucks, airplanes, bicycles, trains and rockets could be included.

Teacher can draw a large spoke type wheel on butcher paper. The title could be "Wheels Help Us." Have the children draw and cut out various machines with wheels and paste them on the inside of the large wheel. Include items which are used at school, at home, or on the farm.

Do experiments.

Wheels make it easier to move heavy objects.
Obtain a large cardboard box and a wagon. Have a child sit in the box and have another child try to push him. It is hard to move the child in the box. Now have the child get in the wagon and have the other child push the wagon. It is easier to move the child in the wagon.

Wheels help you to go faster on a bike than on your own two feet.
Obtain a yardstick, chalk, a bicycle and a rider. Make a short chalk mark on the hardtop. Put the back wheel of a bike on the line. Get one pedal as high as it will go. The rider puts his foot on this pedal. Now he hops aboard. He must push the pedal down and up again to the top. Stop as soon as it gets to the top. He has already taken two steps. One step was down with one leg. The other step was down with the other leg. Mark how far the back wheel of his bike moved from the chalk mark. Now see how many steps you must take to cover the same distance. How many steps? Was it more than two?

PROBLEMS AND CONCEPTS

CONCEPTS - continued

e. You can replace a larger wheel with a crank which acts like a wheel. The pencil sharpener and meat grinder are examples. A longer crank means more power.

f. Sometimes one wheel turns another wheel with a chain.

Pulley

a. A pulley is a grooved wheel or combination of wheels over which a rope or chain is passed.

b. With a pulley we can pull in one direction and it makes an object move in another direction. Pulleys are used on flagpoles, clothes lines and sails on sailboats.

c. Sometimes pulleys help to lift heavy objects.

d. A double pulley can lift something very heavy.

Inclined Plane

a. An inclined plane is a sloping surface.

b. An inclined plane or ramp is used to move a heavy load to a higher place instead of lifting it. Driveways, stairs, cattle chutes, slides are inclined planes.

c. The longer the inclined plane the less force is used, but the distance traveled is greater.

Screw

a. A screw is an inclined plane wrapped around a round object such as a pole or cylinder.

b. A screw may be made to move into or through something.

c. Screws are useful machines for holding things together.

RESOURCES

BOOKS

Podendorf, The True Book of More Science Experiments

Schneider, More Power To You

Sharp, Simple Machines and How They Work

Sonnebone, The Question and Answer Book of Everyday Science

Stoddard, The Story of Power

Zin, What's Inside of Engines?

FILMS

"Energy"
"How Machines and Tools Help Us"
"Machines"
"Machines Do Work"
"Miller Grinds Wheat"
"Safe Use of Tools"

FILMSTRIPS

"Finding Out About Things Around Us"
"Things in the World That Help Us"
"Machines and Tools to Help Us Work"
"Tools and Machines"
"How Wheels Help Us"
"Wheels and Axles"
"Pulleys"
"How Ramps and Screws Help Us"
"Ramps"
"Screws"
"How Wedges Help Us"
"Wedges"
"How Levers Help Us"
"Levers"
"Bob's Rocket"

ACTIVITIES

A large wheel can help turn another wheel.
Turn a bicycle upside down. Use your hand to push a pedal around once. Watch the two wheels with the teeth. As the large wheel connected to the pedal turns, the small wheel connected to the big back wheel turns too. But the little one goes faster. It goes faster because it is smaller. Observe this in the engaging wheels of an egg beater, also pulleys.

Pulleys make it easier to raise and lower a flag.
Have a custodian demonstrate raising and lowering of the flag.

Inclined Plane

It is easier to pull an object up an inclined plane or ramp because the ramp is carrying part of the load.
Obtain a skate, a string, and three books of different sizes and thicknesses. Tie a short piece of string to one end of a roller skate. Make a loop on the string. Put your little finger through the loop and try to lift the string straight up. Now put a large thick book on the table. Lean a flat book against the thick book. Pull the skate up the slanted book. The next time put a smaller book under the slanted book. The lower the incline the more weight the incline is holding and the less weight for the finger to hold.

It is easier to pull a wagon up the driveway than to lift it over the curb.
Try to lift your wagon up over the curb when someone is seated in it. Now pull the wagon up a driveway. Where was the weight of the wagon when it was pulled up the driveway? Where was the weight when pulled over the curb?

Screw

Have the children bring a toy erector set to school and put parts together using the bolts and nuts.

Bring in bottles with screw tops such as Mason jars. Have the children feel the threads of the lids. Screw and unscrew tops to the jars.

Take a piece of paper 9" by 3". Cut the paper into two triangles. Now each piece has an inclined plane. Take one piece and color the slanting edge. Hold the paper in this position and wrap it around a pencil. This will show that a screw is really an inclined plane turned around a rod.

CONCEPTS

Wedge

a. A wedge is two or more inclined planes put together back to back.

b. We use a wedge to break things apart. The wedge and lever often work together. The ax, saw, knife, chisel, hatchet, scissors, plane, and plow are kinds of wedges.

c. All piercing tools are wedges.

d. More work can be done with a large wedge than a small one.

e. Work can be done more easily with a sharp wedge than a dull one.

Lever

a. A lever is a simple machine that helps in lifting things.

b. The three parts of a lever are the weight arm, the fulcrum, and the force arm.

c. The nearer the fulcrum is to the weight, the less force is needed to lift the weight.

d. The nearer the fulcrum is to the force, the higher the weight can be lifted.

e. The claw hammer, crowbar and seesaw are kinds of levers.

f. Nutcrackers, pliers, scissors and tweezers are double levers. There is more force near the fulcrum.

ACTIVITIES

Wedge

Sharpen a pencil with a knife. Wedges may be dangerous unless used with care. Show children that we cut away from the body when using a knife.

Obtain a soft board, a hammer, a nail with a blunt end, and a nail with a sharp end. Try to hammer each nail into the wood. The nail with the sharp point is a better wedge than the nail with a blunt end. You may also do this experiment with an unsliced loaf of bread and a dull knife. Bring a knife sharpener and sharpen the knife. The sharp wedge makes work easier and faster. The children will enjoy the samples of sliced bread.

Lever

Drive a nail into a soft board. Use the claw end as a lever to pry the nail up. Use a crowbar to pry the top off of a wooden crate or lug box.

Experiment with the playground seesaw. Discover what makes the fulcrum. Discover how one child is the weight and the other the force and how their work is exchanged as they alternate going up and down.

PROBLEMS AND CONCEPTS RESOURCES

CONCEPTS - continued

Complex Machines

a. Machines help us to do work more easily or quickly.

b. Some machines help us to have fun.

c. There are many kinds of machines made up of combinations of two or more simple machines. The most modern complicated machines are combinations of the six basic simple machines.

Energy

a. Energy is the ability or capacity to do something -- to work.
   Energy exists in:
   Machines
   Wind
   Running water
   Muscles
   Steam
   Electricity

b. Heat engines make some machines work. An engine is a device that is used to convert some form of energy -- usually heat into mechanical energy.

c. Fuel is burned in all engines to make heat. The engine then turns or changes this heat into motion.

d. Automobiles, trucks, tractors, trains, ships, submarines, jet planes, and rockets are powered by heat engines.

Friction

a. Friction or rubbing makes things hard to move.

b. Friction slows down the work of machines. Friction causes wear.

c. Friction is reduced by using oil on rubbing surfaces.

ACTIVITIES

After each type of simple machine has been introduced, write a group story. Have the children copy the stories and make illustrations to go with each story. Put these together and make a booklet on "machines."

Write up experiments which are made on large chart paper. Illustrate each experiment. Include the conclusion or learning drawn from the experiment. Make a class book. It could be titled "Our Big Book of Experiments."

Show films on energy. Also show filmstrip "Things in the World That Help Us." Discuss the different forms of energy. This film helps the children understand how windmills help pump water. Make a paper pinwheel. Blow on it or hold it up facing the breeze. Make a water wheel by using a spool which is slipped onto a pencil. Tagboard paddles may be tacked onto the spool. Show that the force of running water from the faucet will turn the spool.

Turn a wagon upside down on the lawn. Let the stream of water from a hose run on the wheel. Watch the wheel turn.

Have the children feel the "dead" engine of an auto that is warm from recent running. Explain that inside the engine gasoline burns, and that makes fire which makes the engine go.

Take a field trip to the school boiler room. Look at the furnace. Have the custodian help explain what makes it go and answer questions the children may have.

Make a paper model of a rocket. Directions are in filmstrip "Bob's Rocket." Read to class What's Inside of Engines.

Have a child push or pull a cardboard box with a heavy object in it. First push the box on the sidewalk. Then try it on the grass or loose dirt. Where was there more friction? Where was the pushing easier? Where was it more difficult?

"We're Making Heat" is a song the children can sing. There is a simple experiment the children do by rubbing their hands together as they sing. 'Experiment Songs" is done by Dorothy Collins.

Rub a piece of wood with sandpaper. Feel the heat. Sandpaper the piece of wood to show the wear caused by friction.

PROBLEMS AND CONCEPTS RESOURCES

CONCEPTS - continued

d. Friction is reduced by the use of wheels and ball bearings.

e. Friction can be helpful in braking. Enough friction can stop things that are moving.

f. Friction produces heat.

Machine Care and Safety

a. Machines need proper care.

b. Simple machines of the wedge type such as knives, scissors, and saws should be used correctly in order to avoid accidents.

c. We must know and observe safety rules when near complex machines which move or have engines.

ACTIVITIES

Light a match. Explain that the friction causes enough heat to start a fire in the inflammable material at the tip of the match.

"Machines" is a game the teacher can make for the children to play. Directions are in We Are Neighbors, teacher's manual, in"Wheels Go Round" unit.

Demonstrate with a pencil or piece of chalk the wear caused by friction when writing.

Examine treads of tires worn by friction.

Examine heels and soles of different shoes of children in class.

Read to the class Friction All Around, by Pine.

Rub hands together to produce heat. Apply lotion. Rub hands together and observe lack of heat.

Hold a roller skate upside down and spin one wheel. Can you see the ball bearings? Can you hear the clicking sound of the little steel balls hitting each other as the wheel turns? Discuss what machines have ball bearings. Ball bearings are put between the wheel and axle. They help make the wheel go faster by reducing friction. Observe ball bearings in an egg beater.

Have a child ride a bicycle on the hardtop and apply brakes. Brakes cause enough friction to stop wheels.

Discuss oiling parts of machines that rub against each other. Try to bring an old wagon to school which has been rusted. Do the wheels squeak as they turn? Why? Oil them. What did the oil do?

Let a small iron nail stay in water for a week. Watch rust begin to appear.

List some farm tools that are made of iron and need to be protected from weather.

Make a list of safety rules for tractors and other farm machinery.

SCIENCE GUIDE

Unit Meteorology

Grade Two

Fresno County Schools

HAROLD L. COLES, Superintendent

September, 1964

VOCABULARY

air

atmosphere

barometer

cirrus

clouds

condense

cumulus

dew

droplets of water

evaporate

expand

Fahrenheit (See First Book of Weather for biography)

fog

frost

gauge

hail

hailstones

heat and cold

humidity

ice

lightning

meteorologist

moisture

mountains

precipitation

predict

rain

rainbow

raindrop

rainfall

seasons

sky

sleet

snow

snowflake

storm

storm cloud

stratus

sun

temperature

thermometer

thunder

water vapor

weather

weather balloons

weather forecasting

weather man

weather map

weather reports

weather satellite

weather station

wind

wind vane

APPARATUS, EQUIPMENT, AND SUPPLIES

balloons

basketballs or other inflatable balls

clear glasses (drinking tumblers)

candy thermometer

construction or chart paper

glass or pyrex bottles

hot plate

magazines and newspapers for weather reports and pictures

a mirror

prism

quart size glass jars

small pans or cans of equal sizes

supplies for pinwheels

thermometers (at least two)

teakettle

tin cup or tin can

turkish towels

INTRODUCING THE UNIT

We would suggest a bulletin board showing the three main areas of weather -

heat - sun
air - wind and pressure
water - moisture

This can be presented in numerous ways. Use your own ideas.

The filmstrip #5909, "We Learn About the Weather" is an excellent A-V aid to use in correlation with your bulletin board.

PROBLEMS AND CONCEPTS	RESOURCES
I. What is Weather?	Filmstrip: "What is Weather?"
A. Why is the weather always changing?	Books: Wyler, The First Book of Weather, pp. 12-14 Weather - A Golden Nature Guide, pp. 4-5
B. Is heat part of weather, too?	Bonsall, How and Why Book of Weather, pp. 4-5
C. What is air pressure?	Disney, Man and Weather Satellites, pp. 7-8
D. What about the wind?	Fenton and Fenton, Our Changing Weather, pp. 7-11
E. Didn't we forget water? (moisture)	
	Other Books: Joseph Gaer, Everybody's Weather Eric Sloane's Weather Book Gibson, About Our Weather
	Audio-visual supplies:
	Filmstrips: #6413, "Air, Wind and Weather" #8315, "All My Seasons" #8316, "Daytime and Nighttime" #2102, "The Earth is Always Changing"
	Filmstrip and Record: "Going on a Picnic"
II. Weather is Air	
A. Does air take up space?	Bonsall, How and Why of Weather, pp. 6-7

ACTIVITIES

Make a bulletin board depicting the three factors of weather. (sun-heat, air-wind and pressure, and water-moisture)

Keep a weather chart showing temperature, and type of weather as rainy, foggy, sunny, cloudy, etc.

Keep and collect the weather forecasts and reports from the newspapers and magazines. Include pictures of weathermaking news.

Invert a glass in water. It won't fill because there is air in the glass.

Crumpled piece of paper in bottom of glass will stay dry.

Blow up a balloon. It changes shape as air fills it.

Lower two drinking glasses in water; one upside down, one upright. The upright one will fill, the inverted one won't because it has air while the water could displace the air in the upright glass.

PROBLEMS AND CONCEPTS	RESOURCES
B. What do we call moving air? (wind)	Gibson, About Our Weather, pp. 4-9 Feravolo, Junior Science Book of Weather Experiments, pp. 11-16, 59-63 Wyler, First Book of Weather, pp. 1-7, 17-19, 22-26 Lehr, Burnett and Zim, Weather - A Golden Nature Guide, pp. 34-47 Eric Sloane's Weather Book, pp. 13-28, 49-58, 79-84 Joseph Gaer, Everybody's Weather, pp. 36-45 Fenton and Fenton, Our Changing Weather, pp. 17-37
C. Why is it warmer near the ceiling? (warm air rises)	Adler and Adler, Air, pp. 6-8, 20-22, 46-48 Friskey, True Book of Air Around Us, pp. 7-21 Audio-Visual: Motion Picture: "Air" Filmstrips: #5818, "Air About Us" #5826, "Air Around Us" #6413, "Air, Wind, and Weather" #8317, "A Foggy and a Windy Day" #5913, "What Makes Things Dry Faster?"

ACTIVITIES

Invert a glass with a bent glass tube inserted in it to allow the air to escape into a pan of water. As the air pushes down on the surface of the water it pushes the water into the glass and forces the air out through the tube.

Balance two inflated basketballs on a beam balance (a 1x4 board). Release the air from one. That end will rise. This proves air has weight. Unequal pressures will unbalance the beam.

Moving Air:

Watch moving leaves on trees, clothes on a line, dust in a sandstorm.

Make pinwheels.

Blow your pencils from your desk or fan them to make them move.

Squeeze a hollow ball or balloon to feel the air move.

Discuss things that air can move as kites, sailboats, windmills, etc.

Collect and display pictures of examples of air moving things.

Warm Air Rises:

Tie a balloon to a pyrex bottle or soda bottle. Heat the bottle and the balloon will inflate. Cool the bottle and the balloon will deflate.

Hang a thermometer near the ceiling and another near the floor. Note the different temperature readings. Warmer at the top of the room.

Take two quart fruit jars. Fill one with smoke from a smoldering cloth or cotton. Cover mouth of jar with tagboard. Place on top of other jar with mouths of jars together. Remove card. Smoke doesn't mix. Now reverse so smoke jar is on the bottom. Smoke will rise into other jar.

PROBLEMS AND CONCEPTS	RESOURCES
III. Weather is Water	
A. What are the three forms of water? (vapor, water, ice)	
B. How are these three forms of water related to weather?	
1. Vapor - How does water get into the air? (evaporation)	Lehr, Burnett and Zim, Weather - A Golden Nature Guide, pp. 14-15 Wyler, First Book of Weather, pp. 38-40 Eric Sloane's Weather Book, pp. 59-78 Bonsall, How and Why of Weather, pp. 21-22, 26 Fenton and Fenton, Our Changing Weather, pp. 42-56 Podendorf, True Book of Weather Experiments, pp. 20-36 Friskey, Air Around Us pp. 24-29 Larrick, Rain, Hail, Sleet and Snow, pp. 54-59 Junior Science Book of Weather Experiments, pp. 17-25, 31-37, 42-46 Gibson, About Our Weather, pp. 10-17
2. What are clouds made of?	
3. Why doesn't it always rain when there are clouds in the sky? (cloud types)	
4. What do we call all the different types of clouds?	Clouds: McGrath, About Clouds (entire book) Gibson, About Our Weather, pp. 10-17 Feravolo, Junior Science Book of Weather Experiments, pp. 42-46

ACTIVITIES

Water:

Discuss temperatures of freezing and of boiling water.

Put ice in a container. Heat until ice melts then turns to steam as it boils. This shows the three forms.

Do experiment above using a candy thermometer to observe temperatures of three forms of water.

Water Evaporates: Vapor

Put some water in a glass. Keep track of the lowering water table.

Put out two pans of water, one in the shade and one in the sun. The one in the sun should evaporate first. Thus the concept, "Heat hastens evaporation." A variation might include two pans with same amount of water but different surface area. Smaller surface area placed in sun might not evaporate sooner. Ask why.

Boil water or candy, etc. in the classroom. Watch the steam rise. Watch the lowering water table.

Discuss evaporation of bodies of water.

Water Condenses: Clouds and Rain

Hold a cold glass bottle in the vapor of boiling water. Catch the water that drops from the bottle. (rain)

Place a mirror or other glass over steam. Watch the water collect and condense. Discuss condensation on windows of a warm room on a cold day. (Moisture collects on the inside of the window.)

Fill a tin cup with ice. Set it over a pan of hot water. Watch the water condense on the outside.

Discuss that water cools at high altitudes. Thus vapor condenses and causes rain.

PROBLEMS AND CONCEPTS	RESOURCES
	Larrick, Rain, Hail, Sleet and Snow, pp. 3-15 Friskey, The True Book of Air Around Us, pp. 24-29 Joseph Gaer, Everybody's Weather, pp. 46-53 Fenton and Fenton, Our Changing Weather, pp. 46-56 Bonsall, How and Why of Weather, pp. 38-39 Eric Sloane's Weather Book, pp. 59-78 Wyler, First Book of Weather, p. 40 Lehr, Burnett and Zim, Weather - A Golden Nature Guide, pp. 14-20 Audio-Visual: Filmstrips: #8317, "A Foggy Day and a Windy Day" #5901, "How Does Water Get Into the Air?" #5913, "What Makes Things Dry Faster?" #5914, "Where Do Clouds Come From?"
5. What makes it rain?	Lehr, Burnett and Zim, Weather - A Golden Nature Guide, pp. 23-23 Wyler, First Book of Weather, pp. 41-42 Gibson, About Our Weather, pp. 18-22 Feravolo, Junior Science Book of Weather Experiments, pp. 31-37 Larrick, Rain, Hail, Sleet and Snow, pp. 16-25 Friskey, True Book of Air Around Us, pp. 34-39 Joseph Gaer, Everybody's Weather, pp. 60-61 Podendorf, True Book of Weather Experiments, pp. 20-35 Fenton and Fenton, Our Changing Weather, pp. 57-62 Blough and Bendick, Not Only For Ducks. Entire book - excellent read aloud book. Bonsall, How and Why Book of Weather, p. 28

Fog is low clouds. Discuss this.

Feel moisture in fog. Grass and hair get wet. Water drops from trees and buildings in the fog.

Hang a turkish towel in the fog. Note it gets wet.

There are many types of clouds. Discuss types and names. Note differences in their color and appearances.

Discuss the ways the condensation experiments, the fog experiments and the cloud experiments are all part of the answer to the question what makes it rain.

Read, Not Only For Ducks, by Blough and Bendick.

Listen to the record, Rec S114 "What Makes Rain."

Many other excellent audio-visual aids are also available on this subject.

Make a picture story of the life of a raindrop from evaporation, to cloud, condensation, rain, return to large body of water and to evaporation again.

PROBLEMS AND CONCEPTS	RESOURCES
	Audio-Visual Aids: Motion Picture: "What Makes Rain?" Filmstrips: #8319, "A Rainy Day" #5123F, "A Walk in the Rain" #5817, "Water, Water, Everywhere" #3005F, "Finding Out About Land, Air and Water" #3323 "Experiences with Water" Record: #S114, "What Makes Rain?"
6. What are thunder and lightning?	Lehr, Burnett and Zim, Weather - A Golden Nature Guide, pp. 96-100 Wyler, First Book of Weather, p. 43 Bonsall, How and Why Book of Weather, pp. 30-32 Fenton and Fenton, Our Changing Weather, pp. 63-67 Joseph Gaer, Everybody's Weather, pp. 63-64 Friskey, True Book of Air Around Us, pp. 30-33 Larrick, Rain, Hail, Sleet and Snow, pp. 26-32 Gibson, About Our Weather pp. 23-25
7. Can people make it rain?	Rainmaking: Lehr, Burnett and Zim, Weather - A Golden Nature Guide, pp. 31-33 Wyler, First Book of Weather, pp. 47-49
8. What is a rainbow?	Rainbow: Bonsall, How and Why Book of Weather, p. 34 Joseph Gaer, Everybody's Weather, pp. 56-58 Gibson, About Our Weather, pp. 26-27

ACTIVITIES

Read about and discuss thunder and lightning. Since lightning is a form of electricity, an experiment with static electricity will help describe it. Tear tiny bits of paper. Put them on the table. Then take a pocket comb and rub it on a woolen sweater. Show how it will then pick up the paper. Discuss other forms of static electricity. Explain that thunder is produced when the air is instantly heated by the electricity passing through it and so is caused to expand violently.

Discuss rain dances. Talk about cloud seeding with salt and why it helps make rain. Mr. Rabbit the Rainmaker is an enjoyable story found in the State Series Grade Two Reader, We Are Neighbors. It isn't scientific but would make an interesting introduction to rainmaking.

Rainbow:

Discuss what causes rainbows. Talk about rainbows in the sprinkler and in soap bubbles.

Use a prism to make a rainbow.

PROBLEMS AND CONCEPTS	RESOURCES
9. How can we measure rain? (make a rain gauge)	Feravolo, Junior Science Book of Weather Experiments, pp. 38-41 Podendorf, True Book of Weather Experiments, pp. 22-23 Wyler, The First Book of Weather, p. 46
10. What makes frost, hail and sleet?	Larrick, Rain, Hail, Sleet and Snow, pp. 37-53 Gibson, About Our Weather, pp. 28-31 Wyler, First Book of Weather, pp. 36-38, 49-51
11. Isn't snow just frozen rain? (No)	Lehr, Burnett and Zim, Weather - A Golden Nature Guide, pp. 21-33 Bonsall, How and Why of Weather, pp. 27-29 Fenton and Fenton, Our Changing Weather, pp. 68-76 Joseph Gaer, Everybody's Weather, pp. 62-71 Audio-Visual: Motion Pictures: "Animals in Winter" "Play in the Snow" "What Frost Does" Filmstrips: "Autumn and Winter" #5106f, "Getting Ready for Winter" #5117, "In the Winter" #8320, "A Snowy Day" #1002, "Winter Adventures"
IV. Temperatures	
A. How can we measure heat and cold? (using a thermometer)	Feravolo, Junior Science Book of Weather Experiments pp. 5-10 Bonsall, How and Why Book of Weather, p. 35 Podendorf, True Book of Weather Experiments, pp. 10-19 and 47 Wyler, First Book of Weather, pp. 15-16

ACTIVITIES

Rain Gauge:

Make a rain gauge with a straight sided glass or can. Place it in a place away from buildings, trees or other obstructions. When the rain has stopped, measure the rain in the container.

Frost, Sleet and Hail:

Read from one or several books on hail, sleet and frost. Discuss.

Especially good is Rain, Hail, Sleet and Snow by Larrick, pp. 37-53.

Snow:

Read about and discuss snow and snowflakes.

Make paper snowflake Discuss the fact that no two snowflakes are ever the same.

Temperatures:

Keep a weather chart showing the temperature at the same time each day for 2 or 3 weeks.

Place two pans of water out. One in the sun and one in the shade. Take the temperature of each after two hours. Note one in sun is warmer.

Draw and collect pictures illustrating the seasons. Write stories to describe them.

Keep two thermometers. One inside, one outside. Check these for differences in indoor and outdoor temperatures.

PROBLEMS AND RESOURCES	RESOURCES
B. What part does heat play in the weather story? (the seasons)	Lehr, Burnett and Zim, Weather - A Golden Nature Guide, pp. 5-11 Fenton and Fenton, Our Changing Weather, p. 26, pp. 7-16, 21-27 Wyler, First Book of Weather, pp. 8-11 Podendorf, True Book of Weather Experiments, pp. 6-9 Bonsall, How and Why of Weather, pp. 11-15
C. Why must we dress warmer in winter?	Podendorf, True Book of Weather Experiments, pp. 18-19 Joseph Gaer, Everybody's Weather, pp. 11-34 How and Why of Weather, p. 10
D. Why is it cooler at night than in the daytime?	Bonsall, How and Why of Weather, p. 10 Audio-Visual: Motion Pictures: "Big Sun and Our Earth" "Animals in Autumn" "Animals in Spring" "Animals in Summer" "Animals in Winter" "Autumn on the Farm" "Children in Spring" "How Sunshine Helps Us" "Spring on the Farm" "Summer on the Farm" Filmstrips: #2018, "Earth and the Sun" #5602, "Moon, Sun and Stars" #8315, "All My Seasons" "Autumn and Winter" #8316, "Daytime and Nighttime" #2102, "Earth is Always Changing"

ACTIVITIES

Excellent time to teach an arithmetic unit on reading a thermometer.

Dress according to temperature:

Wrap two cans, one with white, one with black paper. Put both in the sun for 20 - 30 minutes with a thermometer in each. The black can should be warmer as black absorbs heat while white reflects it. Thus we wear darker shades on colder days.

Take two jars of hot water. Wrap one in a woolen sweater or scarf. Leave for 1 hour. Take the temperatures of each. The wrapped one will be warmer as wool retains heat inside (as a thermos jug) - thus wool and heavy clothes in the wintertime to hold in the heat.

Use filmstrip #1721, "Susan and Peter Dress to Match the Weather."

Day and Night:

Read and discuss the subject.

Use excell[illegible] filmstrip #8316, "Daytime and Nighttime" - also filmstrip #591 , "Why is the Night Cooler than the Day?"

PROBLEMS AND CONCEPTS

RESOURCES

Filmstrips:
- #804f, "Fall Adventures"
- #5106f, "Getting Ready for Winter"
- #8318, "A Hot Day"
- #5173, "In the Autumn"
- #5114, "In the Spring"
- #5116,"In the Summer"
- #5117, "In the Winter"
- #5920, "Seasons"
- #826, "Spring Adventures"
- #2016, "Spring and Summer"
- #902, "Summer Adventures"
- #1721, "Susan and Peter Dress to Match the Weather"
- #2623, "Weather Changes"
- #307, "What Do You Wear?"
- #5917, "Why is the Night Cooler than the Day?"
- #1002, "Winter Adventures"

Record:
- LP 478 The Months Op. 27a Tchaikovsky

ACTIVITIES

PROBLEMS AND CONCEPTS	RESOURCES
V. Can we tell what the weather will be like tomorrow? (weather predictions) A. Facts and fables on weather predicting.	Joseph Gaer, Everybody's Weather, pp. 36-39, 54-59 Wyler, First Book of Weather, pp. 61-62 Fenton and Fenton, Our Changing Weather, pp. 108-110 Lehr, Burnett and Zim, Weather - A Golden Nature Guide, pp. 147-156 Eric Sloane's Book of Weather - entire book
B. What does a weatherman do and what tools does he use in his work?	Bixby, Sky Watchers, (teachers' references) - entire book Wolfe, Let's Go to a Weather Station - entire book Joseph Gaer, Everybody's Weather, pp. 86-87, 90-91 Podendorf, True Book of Weather Experiments, pp. 44-47 Wyler, First Book of Weather, pp. 56-60 Fenton and Fenton, Our Changing Weather, pp. 103-107 Lehr, Burnett and Zim, Weather - A Golden Nature Guide, pp. 130-146 Eric Sloane's Book of Weather - entire book Weather Instruments: Wolfe, Let's Go to a Weather Station - entire book Bonsall, How and Why of Weather, pp. 35-36 Joseph Gaer, Everybody's Weather, pp. 88-89 Feravolo, Junior Book of Weather Experiments Wyler, First Book of Weather, pp. 56-60 Fenton and Fenton, Our Changing Weather, pp. 103-107 Lehr, Burnett and Zim, Weather - A Golden Nature Guide, pp. 112-129 Audio-Visual: Motion Pictures: "Weather Station" "Whatever the Weather" Filmstrip: #2623, "Weather Changes"

ACTIVITIES

Read and discuss the facts and fables of weather predicting. Good sources are available. (Sloane's Weather Book)

Collect and check sources of long range weather predictions. Farm Journal magazine and an Almanac available at a Rexall Drug Store are two such sources.

Learn some of the rhymes from Franklin's "Poor Richard's Almanac" as Red in Morning, Sailors Warning, Red at Night, Sailors Delight.

On investigation we found guided tours of the Fresno Weather Bureau were not available. A self-directed trip can be taken at your risk.

The book, Let's Go to a Weather Station, to be read to the class is an excellent source of information.

Motion picture "Weather Station" is an excellent source of information!

Discuss the latest developments on the use of satellites in weather reporting and predicting.

An excellent single source on the weather satellite is Walt Disney's book, Man and Weather Satellites, to be used as a read aloud to the class.

Collect and display pictures and articles on space travel and weather forecasting.

PROBLEMS AND CONCEPTS	RESOURCES
C. What is a Weather Satellite?	Adler, Air, pp. 36-37 Disney, Man and Weather Satellites - entire book to be read to class Joseph Gaer, Everybody's Weather, pp. 92-93 Audio-Visual: Motion Picture: "Space Flight Around the World" - 112S Record: LP #436, "Space Songs"

ACTIVITIES

BIBLIOGRAPHY

We shall divide this in three sections: Teachers' references, Read Aloud books as second graders have such a limited reading vocabulary, and Students' books.

1. Teachers' reference

Adler, Irving and Ruth: Air, John Day Company, New York. A reason why book.

Bixby, William: Skywatchers, David McKay Company Inc., New York. Story of the U.S. Weather Bureau in action.

Bonsall, George: The How and Why Book of Weather, Grosset and Dunlap, New York. Excellent reference and guide in teaching a weather unit.

Burnett, R. Will; Lehr, Paul E.; Zim, Herbert S.: Weather - A Golden Nature Guide, Golden Press, New York. Excellent reference.

Fenton, Carroll Lane, and Fenton, Mildred Adams: Our Changing Weather, Doubleday and Company Inc., Garden City, New York. Also good oral material.

Gaer, Joseph: Everybody's Weather, J.B. Lippincott Company, Philadelphia and New York. Wonderful photographs - one on every other page.

Sloane, Eric: Eric Sloane's Weather Book, Duel, Sloan and Pearce, New York. Good on why there are weather changes. Also good on folk tales of weather.

2. Read aloud books

Blough, Glenn O.: Not Only For Ducks, Whittlesey House, McGraw Hill Company, New York. Attractive and enjoyable read aloud book. Written especially for this purpose.

Disney, Walt: (adapted for school by Willy Lay) Man and Weather Satellites, L.W. Singer Company Inc., Syracuse, New York. Narrative type on the history of weather. Sounds like Walt Disney's narratives on his TV program.

Feravolo, Rocco V.: Junior Science Book of Weather Experiments, Garrard Publishing, Champaign, Illinois. Grade 3 reading level but of great interest to second grade. Suggest reading aloud to overcome vocabulary barrier.

Friskey, Margaret: The True Book of Air Aound Us, Children's Press, Chicago. Another book written for the primary reader but geared more for grade 3.

Larrick, Nancy: Junior Science Book of Rain, Hail, Sleet, and Snow, Garrard Press, Champaign, Illinois. Written for the Primary Reader but limited to top group in second grade.

Wolfe, Louis: Let's Go to a Weather Station, G.P. Putnam's Sons, New York. Written for young reader on a higher level. Excellent source of weather station information.

Wyler, Rose: The First Book of Weather, Franklin Watts Inc., New York, N.Y. Excellent source for selected reading on special topics for information.

3. Students' books

Gibson, Gertrude Hevener: About Our Weather, Melmont Publishers Inc., Chicago, Ill. Good reading and illustrations.

McGrath, Thomas: Clouds, Melmont Publishers Inc., Chicago, Ill. Teaches types of clouds and their names.

Podendorf, Illa: The True Book of Weather Experiments, Children's Press. We used many of these in the unit.

NOTE: Some of the books in the read aloud section will also be suitable for readers in a top reading group.

HLC:nb

SCIENCE GUIDE

Unit Heat

Grade Two

Fresno County Schools

HAROLD L. COLES, Superintendent

September, 1964

VOCABULARY

absorbs

automatically

burn

chemical

constantly

contract

dangerous

degrees

electricity

energy

expands

evaporate

Fahrenheit

flame

freeze

friction

magnifying

mercury

reflects

rough

smooth

sources

spontaneous

surfaces

temperature

thermometer

thermostat

APPARATUS, EQUIPMENT AND SUPPLIES

- aluminum, piece of
- bolt
- bottle, vacuum and pyrex
- bowls - 2
- brass, piece of
- bread
- butter
- cardboard, piece of
- camera negative
- can - 2 tin
- candles - 6
- chair
- clay
- cloth - black & white
- cloth - 2 pieces 2 yds. long
- coin
- cotton material to match wool sweater
- drill
- drinking glass
- electric iron
- eraser
- file
- glass, piece of window
- glass, piece of
- glass tube
- glove, cloth and leather
- hammer
- hot plate
- ice
- ink, red
- ink bottle
- iron, piece of
- jars - 4 with screw lids
- jars - 4 different sizes
- Jello
- lamp chimney
- magnifying glass
- matches, wooden
- metal, piece of
- nail
- oil
- pan
- paper
- paraffin
- pencil
- picture wire
- pinwheel
- pliers
- popcorn
- popper
- rods - 3, steel, iron, and porcelain
- rod - copper
- rope
- rubber, hard
- sand
- sandpaper
- saw
- screwdriver
- socks - 3, nylon, wool, and cotton
- spoon, silver
- straw
- sweater, wool
- thermometers - 3
- thread
- toaster
- wood block
- wood, piece to saw
- wool, piece of

INTRODUCING THE UNIT

A good discussion of heat is one way to start.

Some questions suggested for the introducing the unit are:

1. What is heat?
2. Where does heat come from?
3. What keeps us warm?
4. Would a snowman get warm with a coat on?
5. What keeps animals warm?
6. What cooks our food?
7. Why does the sand burn your feet?

A bulletin board is very valuable.

Make a chart showing things that give us heat. Make a chart showing things that need heat.

PROBLEMS AND CONCEPTS	RESOURCES
I. What is heat and how does it act?	Navarra & Zafforoni, Today's Basic Science, Book 2, Teacher's Edition, pp. 101-111
A. Heat is a form of energy. Heat cannot be seen, weighed, or heard.	Parker, Bertha Morris, Science Experiences in the Elementary School, pp. 158-178
Heat is the rapid back and forth movement of molecules.	Pine & Levin, Heat All Around, 1963
	Schneider, Herman & Nina, Let's Find Out
	Film: "Heat and Light"
	Filmstrip: "Finding Out About Things Around Us"
B. Heat travels quickly through metal.	
Heat does not travel quickly through some material.	Beauchamp, Science is Learning, pp. 33-40, 46
C. Things expand when they are heated and contract when they are cooled.	Schneider, Let's Find Out, pp. 6-7
D. Air rises when heated.	Craig, Science for the Elementary School Teacher, new edition, pp. 416-419
II. What are the sources of heat?	Beauchamp, Science Is Learning, pp. 25-46
A. Sun	
1. The sun is the most important heat producer. Scientists have found new ways to use this energy.	Frasier, Seeing New Things, pp. 104-105
	Heath, Science for Here & Now, p.4
	Filmstrip: "Where Do We Get Heat?"

ACTIVITIES

Discuss things that are hot or sometimes hot. Have children bring pictures to school to illustrate hot things. Make a chart or poster. Make a "cold" chart for comparison.

Light a candle; let the child feel the heat around the candle. Do the same with a small lamp bulb. Do the same with an electric plate.

Pour hot water over a jar with a tightly screwed on lid. After you dry it the lid can be easily removed. (The heat of the water caused the lid to expand.)

Tie one end of a piece of picture wire to a screwdriver. Tie the other end of the wire to the back of a chair. The screwdriver blade should be just under the bottom rung of the chair. Hold a lighted candle halfway up the wire. Put a pan or paper on the floor to catch the melted wax from the candle. Did the wire get longer? Look at the screwdriver and you will see. As the wire cools, what happens to the screwdriver?

Name the sources of heat. Bring pictures of all the sources of heat and make a chart showing each.

Sample

1. Sun	2. Fires	3. Electricity	4. Friction
	Natural (coal (oil (gas (wood	Electrical (dryers (heaters (irons (toasters	

Feel a metal object left in the sun, such as a metal lunch box. Feel the sun's heat on face.

PROBLEMS AND CONCEPTS	RESOURCES
A. Sun - continued	
2. It is warmer in the sun than in the shade.	Craig, Science Around You, pp. 53-57
3. Heat from the sun makes the land warm.	Schneider, Science for Work and Play, pp. 135-136
4. Plants need correct temperature to grow.	Beauchamp, Science Is Learning, pp. 108-115, 122
	Heath, Science for Here & Now, pp. 33-35
	The Wonderworld of Science
5. Clouds cut off some of the heat from the sun.	
6. It usually gets warmer during the day when the sun shines and cooler at night when the sun sets.	
7. Winter days are usually cooler than summer days.	
8. Mountain areas are usually cooler than valley areas.	
B. Fire	Films: "Fire" "Understanding Fire" "Fire - What Makes It Burn?"
1. We get heat from fire.	
2. When something burns it gives off heat.	Adler, Irving, Fire in Your Life, 1955
3. Fire Needs Fuel. Coal, oil, gas and wood are natural fuels used to give heat when needed.	Tannenbaum & Stillman, We Read About Fire and How It Is Used
4. Fire can be helpful. Fire can be harmful.	Baker, Around the Corner, pp. 42-43
5. A fire needs air to burn.	Schneider, Science for Work and Play, pp. 26-29
	Parker, Bertha Morris, Science Experiences in the Elementary School, pp. 170-178

ACTIVITIES

Put the same amount of water in two bowls. Feel temperature (hand or thermometer). Put one bowl in the sun. Put one in shade. Take temperature again in 20 or 30 minutes. What happened? The water in the sun became heated by the sun's rays and caused the temperature to rise.

Do the same with a pan of sand in the shade and a pan of sand in the sun.

Line a jar with paper toweling or blotting paper and keep about an inch of water at the bottom of the glass. Slip seeds between the paper and the glass. Set up two jars, each with the same kind and number of seeds. Set one in the refrigerator. Set the other in a warm place. Which seeds will be the first to sprout?

Wet two sponges (or pieces of cloth). Place one in the sun and one in the shade. Which one dries faster? Why?

Put one pan of sand in the sun and one in the shade. Put a thermometer in each of the pans. Check the thermometers at different times of the day.

Which pan of sand is the warmest? At what time of day is the temperature the highest?

Temperature		
Time	Shade	Sun
9:00	70°	90°

Chart

Put one thermometer on a post in the sunshine. Put another thermometer on the same post but on a shady side. Do they say the same thing? Which side is warmer? How much?

Put the thermometer on the top of the ground. Put it under a stone. Put it in some water that has been standing outdoors.

How warm was it in each of these places? Which place was the warmest? Which place was the coldest? Is the water colder than the ground?

Light a birthday candle and watch it until all the candle is burned.

Discuss how fire goes out in fireplaces and campfires when all the wood is burned.

Discuss how fire goes out in burner of gas stove when gas is turned off.

Light two birthday candles. Cover one with a jar. Notice which one goes out first. Explain that a candle in a Jack-O-Lantern does not burn long without sufficient air.

Cover a candle flame with a teaspoon.

Tell about putting out campfires with soil.

PROBLEMS AND CONCEPTS	RESOURCES
B. Fire - continued	
6. A fire can be started by bringing the sun's rays together with a magnifying glass.	Dowling, The New Seeing Why, pp. 171-182
C. Electricity	
We get heat from electricity.	Parker, Bertha Morris, Science Experiences in the Elementary School, pp. 128-142 Bond, Thinking About Science, pp. 138-140 Frasier, Seeing New Things, pp. 217-219 Navarra & Zafforoni, Today's Basic Science, Book 1, pp. 103-106 Thurber, Exploring Science, Book 2, pp. 100-102 Dowling, The New Seeing Why, p. 181

ACTIVITIES

Direct the sun's rays through a glass to the back of your hand. How does it feel?

Put a pan in the sunshine. Put the paper in the pan on the ground. Put the magnifying glass over the paper in the pan. Make a spot of sunshine on the paper.

What happened on the bright spot on the paper? Why did we have to put the paper in the pan?

Why is something that is burning dangerous?

Discuss need for caution in handling magnifying glass in the sun. One could be burned if not careful.

Discuss possibility of forest fires started by bottles left on the ground.

List things at home that give off heat.

Collect pictures of stoves, heaters, irons, dryers, etc. Discuss how they are used.

Discuss the hot plate and how electricity gives off heat.

Is air hotter closer to a heated electrical iron?

Experiment: Put the thermometer two feet from the iron and record the temperature.

Let the thermometer come back to room temperature.

Put it six inches from the iron and record that temperature. (Let it come back to room temperature.)

Put it one foot from the iron and record that temperature.

Which of the three readings is the highest?

Does the highest reading mean that is the hottest?

Where is the air hotter - at two feet, six inches, or one foot?

PROBLEMS AND CONCEPTS	RESOURCES
II. What Are the Sources of Heat (Cont'd.)	
D. Friction	Pine and Levin, Friction All Around, 1960
1. Friction is an important source of heat.	Parker, Science Experiences in the Elementary School, 1958, p. 158
2. Pressure can generate heat.	
	Craig, Science Around You, pp. 110-117
3. The greater the resistance the greater the generation of heat.	
a. Safety matches will ignite when kindling temperature is reached due to heat from friction and resistance.	
b. Carrying matches in pockets can be a fire hazard.	
4. Friction can cause a fire to start.	Nelson, L., Science Activities for Elementary Children, 1958, p. 114

ACTIVITIES

Rub erasers quickly on desk, then feel.

Rub your hands together very fast until hands feel warm. Try the same thing again but exert pressure. What happened? What can you say about pressure and heat?

Saw a piece of wood. Feel the saw.

Rub a coin on paper. Rub sandpaper on paper. Rub sandpaper on wood. Rub another piece on paper on the wood. Did it get warm? How did the sandpaper feel? Did the sandpaper wear the wood away?

Rub sandpaper on a piece of glass or metal. Can you make the sandpaper get warm?

Pound a nail part way into a board. Feel the nail. Did it get warm?

Drill a hole in a block of wood. Feel the end of the drill. Why is it hot?

Hang a rope from a monkey bar tree or frame. Climb up the rope. Slide down again. What did you feel? Was the rope hot?

Have the class watch while you strike various surfaces with kitchen matches. Repeat with safety and paper matches. What are the conclusions? Does surface make any difference? Does the number of times you strike make any difference?

Have a Boy Scout demonstrate making a fire by rubbing two sticks together.

PROBLEMS AND CONCEPTS	RESOURCES
III. What are some uses of heat?	Film: "Heat & How to Use It" Filmstrip: "What Is Heat and What It Does" Schneider, Science for Here and Now, pp. 109-112
A. We use heat to heat our homes and to keep us warm.	
We get warmth from hot air.	Schneider, Science for Work and Play, p. 30
When hot air touches something it gives heat to it.	Schneider, Let's Look Inside Your House, 1958, pp. 12-21
When air is heated it moves upward.	Dowling, The New Seeing Why, pp. 114-125 Beauchamp, Science Is Learning, pp. 41-43 Thurber, Exploring Science, pp. 162-163
B. We use heat for power.	Bond, Thinking About Science, pp. 100-111
Steam and electricity produce heat which produces power	Dowling, The New Seeing Why, pp. 161-162
1. Heat changes things.	Navarra & Zafforoni, Today's Basic Science, Book 2, pp. 156-167
a. Heat changes solid things to liquids and liquids to gases. (Physical Change)	Baker, Around the Corner, p. 33

ACTIVITIES

Bring pictures to show how people use heat. Make a bulletin board display of cooking, heating homes, burning trash, making glass, etc.

Make a chart showing:

1. Things that keep us warm.
2. How heat is used in cooking.
3. How heat is used for power.

Invite the custodian in to talk to the class on how the school is heated. Tour the plant with the custodian. Does your school heating system use steam, hot air, or hot water?

Ask children to list ways that we use heat in our homes to keep them warm.

Hold a pinwheel over a teakettle of water. The steam will turn the pinwheel.

How does a furnace make heat in a radiator?

Put water in a teakettle and heat. As the water gets hot, hold the bottle close to the teakettle spout. What comes into the bottle? Does the bottle get hot? Why?

When water becomes hot it becomes steam. Steam, as other things, goes up when hot. Steam is forced up through radiator pipes to produce heat for buildings.

Have each child make a scrapbook with pictures showing how heat helps us.

Find pictures of steam and gasoline engines, trucks, cars, electric motors, diesel engines, a glassmaker, a worker cutting a steel beam with a blowtorch, etc.

Make ice cubes to demonstrate that heat removed from water causes it to become a solid.

Heat water in a teakettle to demonstrate that water vapor escaping from the spout is a gas known as steam.

Condense steam by holding a spoon over the spout. Observe how the steam changes back to the liquid state.

Melt some ice in a pan on a hot plate. Boil the water to make it change to water vapor. Use an open pan to clarify the point that steam is invisible.

Place a mirror in the steam cloud and let drops of water fall back in the pan.

PROBLEMS AND CONCEPTS	RESOURCES
III. What Are Some of the Uses of Heat (Continued)	
b. Burning changes materials. When fuels burn they change to ashes, smoke and other materials.	
c. Cooking changes food. (Chemical Change)	
d. We dry some foods in the sun	
C. We use heat to cook our food. Some foods are not palatable eaten raw, some are. Some foods are not digestible eaten raw. Heating food destroys some germs.	
D. We use heat to dry our clothes. Heat evaporates water.	Frasier, Seeing New Things, pp. 50-51 Schneider, Science for Here and Now, p. 135 Thurber, Exploring Science, pp. 161-167 Let's Look Around, pp. 31-34, Beckley-Cardy Co.
IV. A thermometer measures heat.	Bond, Thinking About Science, pp. 116-121 Thurber, Exploring Science, pp. 33-48 Schneider, Science for Here and Now, pp. 113-122 Filmstrips: "Measuring Temperature" "Finding Out" "Thermometers" Films: "Thermometer" "Piro and the Thermometer"

ACTIVITIES

List things children see melting, such as ice cream, a candle, butter, crayons.

List things that change from liquid to solid.

Compare the form of wood or paper with that of ashes after burning.

Put some white sugar into a pan. Heat the pan on a hot plate. Keep stirring the sugar as it cooks. Observe the chemical change to caramel. Contrast this with the physical change of the water in a previous experiment.

Examine fresh and dried foods, prunes, grapes and raisins.

Compare the taste of raw and cooked foods, as carrots, eggs, meat, potatoes. Cook some foods and observe changes. Is spaghetti palatable raw?

Discuss reasons for using pasteurized milk.

Visit cannery to observe use of heat in canning foods.

Make a bulletin showing clothes drying on a line, being ironed, at a laundry or laundromat, and in an electrical dryer.

Make a simple thermometer. Fill a small bottle with red ink. Put a glass tube or straw into it. Put clay around the straw at the top of the bottle. Be sure the top of the bottle is tightly sealed. Heat the flask with a candle. Ink will rise in the tube. (Things expand when heated and require more space. Things contract when cooled and require less space.)

Make a ribbon thermometer and show children how to read a thermometer. Introduce concept "below zero." Read numbers at 2° intervals only, not the finer markings. Notice that the markings go from 32° to 212° with a 180° variation. Notice that heat mark is about 68° and ice is 32°.

Watch the red line in a thermometer rise as it gets warmer, and go down as it gets cooler. Put a finger on the thermometer bulb. Notice that the line rises because mercury is very sensitive to heat.

PROBLEMS AND CONCEPTS	RESOURCES
A thermometer is used to measure the temperature of many things.	
	Craig, Science Around You, pp. 35-37
V. Our bodies produce heat.	
Animals have coats to keep them warm.	
	Schneider, Science for Here and Now, pp. 81-83
Woolen clothes keep us warm by holding in the heat of our bodies.	
	Schneider, Science for Work or Play, pp. 1, 11, 24, 40-41
Different kinds of clothing are suitable in different kinds of weather.	
	Adler, Irving & Ruth, Why and How, John Day, 1963, pp. 16-17

ACTIVITIES

Put the thermometer in ice water or a bowl of cracked ice. Read the thermometer. Tell what number the red mercury is on. Put it in hot water. Did the mercury go up, or down? Notice that heat caused the mercury to expand and fill a larger space.

Make a display of various types of thermometers. Label them according to their uses. Explain how a fever thermometer works. How does mother use a cooking thermometer? Why is there a thermometer in a car?

Keep a record for a month of thermometer readings made daily at approximately the same time from a thermometer kept in the same place, preferably outside.

Watch the thermometer in the classroom and by proper ventilation see that the temperature is as nearly correct as possible.

Keep a chart of two different daily readings from the same thermometer. Does the temperature change during the day?

Make a temperature record.

Temperature		
Time	Inside	Outside
9:00	70°	50°
Time	Shade	Sun
9:00	70°	90°

Discuss the following questions with your class. Does warmth come from the bodies of animals? Why does a mother hen gather the chickens under her? Why do animals huddle together when it is cold? Why do we hug up close to a brother or sister in bed on a cold night?

Collect and show pictures of birds and furry animals. Why do birds have feathers? Why do some animals have fur coats?

Invite the school nurse to speak to the class about body temperature.

Discuss how sickness affects body heat. Let children take their own temperature.

Fill two jars with hot water. Wrap one in a wool sweater. Leave the other one as it is. Let them stand for two hours. Feel the water. Does wool help to keep the heat in?

Wrap a thermometer in a wool sweater. Place it in the sun. Wrap another thermometer in a piece of cotton material the same color as the sweater. Place in the sun. Leave for 5 minutes. Repeat using other materials, such as silk, nylon, etc. Does heat pass through other material more easily than through wool?

Put a woolen sock on one hand and a cotton sock on the other hand. Touch an ice cube with each. Which hand feels colder?

Discuss the use of sweaters, coats and other apparel used in different types of weather.

V. Our bodies produce heat (Continued)

The human body is not a very good judge of temperature.

ACTIVITIES

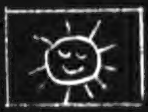
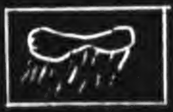
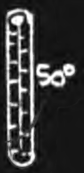
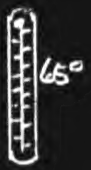
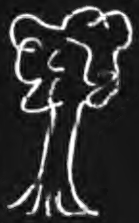
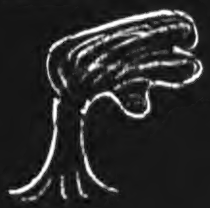
Blow into a cloth and a leather glove as if you were blowing up a balloon. Could you blow up the cotton glove? Did the leather glove get big and fat? Does leather keep out air and cold? Does leather keep in body temperature? Is it water-repellant?

Discuss color of clothing as related to body temperature. Why is light colored clothing better in warm weather and dark clothing better in cold weather?

Experiment: Have two dishes with a piece of butter or ice in each and place them on a cool tray. Place a white cloth or paper over one and a black cloth or paper over the other. Place all this in the sun. Which melted first?

Conclusion: When the sun shines its rays on a black object it soaks up the heat; when it shines on a white object, the heat is thrown off.

Make a chart showing different temperatures of typical weather. By each thermometer show the kind of clothes one would wear for that day.
Keep a weather record as follows:

Day	The Sky		The Air		The Wind	
Monday	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
						

Put cold water in one jar. In another put water as warm as a child could put his hands in. Have a third jar at room temperature. Have one child put his hand in cold water and another in the warm water for a few minutes. Then ask them both to place their hands in the third jar. Observe the difference in what they think of the temperature of the third jar. Use a thermometer to prove that the tepid water remained the same.

Discuss whether the day is warm, just right, or chilly.

Draw the conclusion that a thermometer is a far more reliable method of regulating room heat than "how we feel."

SUMMARY

1. What does heat do for us?
2. Name four ways of producing heat.
3. Which does heat go through faster - (a) metal, (b) glass, (c) wood?
4. Does heat pass through air?
5. What does a thermometer do?
6. What must a fire have in order to burn?
7. How can you stop someone's clothes from burning?
8. How does fresh air get in a furnace?
9. Why does wind make a fire burn faster?
10. Why does covering a fire put it out?
11. How does a thermometer work?
12. What is the usual temperature of a classroom?
13. What is the usual temperature of ice water?
14. Is the temperature higher in shade, or sunshine?
15. How do clothes keep us warm?

HLC:rk

SCIENCE GUIDE

Unit Astronomy
Grade Two

Fresno County Schools
HAROLD L. COLES, Superintendent
September, 1964

VOCABULARY

air
air pressure
astronaut
bright
clear
cloudy
dark
darkness
day
daylight
directions
distance
earth
east
empty
faint
far
farther
farthest
flight
gravity
heavenly bodies
large
larger
largest
length
long
measure
meteor
moon
motion
movement
night
north
objects
orbit
outer space
part
patterns
planet
position
reflect
rocket
rotation
satellite
shadow
shape
"shooting star"
short
small
smaller
smallest
south
space
spaceship
sun
sunny
sunrise
sunset
surface
travel
west
world

APPARATUS, EQUIPMENT AND SUPPLIES

board
chart paper
charts (or make them)
filmstrip projector
flashlight or projector
globe
magazines
modeling clay
"Moon Ball" or other ball
motion picture projector
newspapers
objects of varying sizes
paper towels
plants (2)
ruler
stick puppets
thermometer (outdoor)
toy balloon
yardstick

INTRODUCING THE UNIT

We began our unit with the earth, our home. Some children seemed to be a little fearful that they might topple off as we turned through space. From here it was easy to go into the next part of our unit, space. Then we touched on the bodies in space with which we are more familiar: the sun, moon and stars.

The filmstrip "What Is in the Sky?" is very good to use with this beginning.

EARTH

PROBLEMS AND CONCEPTS	RESOURCES
A. The earth is one of nine planets. Planets are heavenly bodies which move around the sun. It takes the earth one year to move around the sun.	Charts and pictures showing the sun and the planets. Filmstrips: "What Is in the Sky?" "Finding Out About the Sky" "Bob Builds a Telescope" "Finding Out About Land, Air, Water" Motion Pictures: "Big Sun & Our Earth" "Our Home the Earth"
B. A planet shines by reflecting sunlight. The earth gets heat and light from the sun.	Filmstrips: "The Earth and the Sun" Branley, A Book of Planets for You Wyler, The Sky Heath, Science for Here and Now
C. The rotation of the earth causes day and night. A complete turn of the earth is called a whole day. We turn toward the sun in the morning and away from it in the afternoon.	Motion Pictures: "What Causes Day and Night?" "Space Flight Around the World" Filmstrips: "The Sky Above Our Earth" Crowell, What Makes Day and Night?"
D. The seasons and days follow a regular pattern. Where we live the seasons are: spring, summer, fall and winter. Summer is warmer than winter because its days are longer than the days of winter and during summer the sun stands higher in the sky, giving more heat to the earth than on a shorter winter day.	Filmstrips: "In the Autumn" "In the Winter" "In the Spring" "In the Summer" "Why the Seasons" "The Sun and Our Seasons" Study Print: Earth & Sun, Day & Night, Seasons (8 charts) Podendorf, The True Book of Seasons

ACTIVITIES

Show and discuss how planets differ by using a colorful picture or a drawing.

Show how light reflects from the earth by using a globe with light from a flashlight or a projector.

Show, at the same time, darkness on the other side of the earth.

Same as above. Also show that the earth rotates toward the east by using the globe. Mark EAST, WEST, NORTH and SOUTH in the schoolroom. Also post SUNRISE and SUNSET in the proper places.

Let pupils suggest games suitable for play for each season. Utilize this activity by listing and using these games in season.

Also, pupils may list types of clothing worn during each season.

Make and post a weather chart to be used for recording temperatures during the school year. Pupils can check back each month, and at the end of the year, and find the highest and lowest temperatures.

PROBLEMS AND CONCEPTS	RESOURCES
SPACE	
I. Space is all around us.	Motion Pictures: "Space Flight Around the World" "Ocean of Air" "Air" "Air About Us" "Airport in the Jet Age"
A. Space surrounds us.	Grade Teacher Magazine - March '64
B. Space in our homes.	Filmstrips: "Air About Us" "Air Around Us"
C. Space in our schoolroom and on our playground.	
D. Space on our bodies.	
E. Space has distance, or space is distance.	
F. Space can be measured.	
G. The uses of space are variable. The same space can be used for a number of things.	
H. Space has size we can control.	

ACTIVITIES

Watch for different objects or materials that occupy space.
Examples: Flowers, trees, buildings, animals, etc.

Do you have sufficient space in your home? Space for toys? Children discuss why more space might be needed.
Observe space used when a cake is baked. (Batter rising)

Discuss how space is used in classroom. Examples: Desks, tables, etc.
While out playing discover which equipment needs the most space on the playground.
Play a game that requires a small area of space - a large area of space.

Discover what the space on our faces is for - the space inside our mouths.
Demonstrate how a rocket works by blowing up a balloon. Pinch the neck closed. Open fingers and let the balloon go.

Walk short distances, walk long distances. Measure distances walked.
Toss an object a short distance, a long distance.

Things can be near, far, farther, farthest.
See them, measure them.
Compare things that are small, smaller, smallest; large, larger, largest.

Put air into a balloon; put water into a balloon; put air and water into a balloon.

Use an empty jar. Put different substances into it. Examples: Sand, water, etc.

Dig a hole and plant seeds, or pour water in it.

Try playing different games in the same space.

Using the same space, try placing objects of varying sizes into it.

Children form a circle.
Step backward to increase size of circle.
Step forward to decrease size of circle.

PROBLEMS AND CONCEPTS	RESOURCES
II. Outer Space.	
Has no air as we know it. Doesn't have much gravity. We can see the moon, sun, planets and far away stars in outer space. We can see a meteor when it comes into the earth's air from outer space. How do we travel in space that has air in it? What do we hope to use for travel in outer space?	Holsaert, A Book to Begin on Outer Space Podendorf, The True Book of Space Hurst, The Big Book of Space Watts, The First Book of Space Travel Zim, The Sun Wyler and Ames, The Golden Book of Astronomy Wyler, The Sky Record: "Space Songs" Filmstrips: "Getting Ready for a Space Trip" "Rockets to Space" "A Space Trip to the Moon" "What Are Satellites?" "What Are Space Stations?" "What Is in Space?"
SUN	
A. The sun is a star. The sun shines all the time. On cloudy days the sun is shining above the clouds.	Engelbrektson, The Sun Is a Star Branley, The Sun: Our Nearest Star Wyler, My Little Golden Book About the Sky Zim, The Sun Lewellen, The True Book of Moon, Sun and Stars Wyler and Ames, The Golden Book of Astronomy Heath, Science for Here and Now Herman and Nina Schneider, You Among the Stars Barlowe, A Child's Book of Stars Freeman, Fun With Astronomy Crosby, Junior Book of Stars

ACTIVITIES

Exhibit picture of earth in darkness of outer space.

Exhibit pictures of space vehicles.

Use newspaper and magazine pictures of current space flights. Let pupils draw own pictures of spaceships.

Children write a story about their trip in a space ship. Tell what they see and how it feels to ride in space.

Collect short, current articles on satellite launchings and on astronauts and their flights.

Use record - "Space Songs."

Watch clouds as they move across the sky and cover the sun. Observe that the sun reappears as the clouds move on.

PROBLEMS AND CONCEPTS	RESOURCES
B. The sun is the source of the day's light. At night the sun is shining on the other side of the earth. At night we can see the stars and the moon, but not the sun.	Filmstrips: "What Is in the Sky?" "Finding Out About the Sky" "The Earth and the Sun" "Daytime and Nighttime" "Day and Night" Motion Pictures: "What Causes Day and Night?"
C. The sun is very large and very far away.	Lyons and Carnahan, Thinking About Science Craig and Daniels, Science Around You Scott, Foresman, Science is Learning Winston, The New Seeing Why Rand and McNally, Around the Corner Allyn and Bacon, Exploring Science L.W. Singer Co., Seeing New Things
D. The absence of sunlight causes night. A shadow is a dark place made when something blocks the light.	Motion Pictures: "Shadows on Our Turning Earth" Crowell, What Makes a Shadow? Record: "Experiment Songs" by Dorothy Collins
E. The sun gives us heat. Heat from the sun causes tiny bits of water to rise into the air so it can rain.	Heath, Science for Here and Now Lyons and Carnahan, Just For Fun- "The Story of Ibbity"
F. The sun gives off light which contains many colors.	
G. The sun helps plants to grow.	

ACTIVITIES

Mark a spot on the globe with a lump of clay or other material. In a darkened room, use a flashlight, or projector, to represent the sun. Show how one half of globe is lighted.

Rotate globe from WEST to EAST to show how sun apparently rises and sets. As globe rotates have pupils tell what activity they might be engaged in at that time of day.

Pupils observe rising and setting of sun - day and night.

Using a large round yellow paper cut to represent the sun, have a child hold it near then walk away with it. Compare how it looks, as to size, when it is near and when it is far away.

Compare darkness in a lighted and unlighted room.
Using an appropriate background let pupils make shadow pictures.
Using heavy paper, mounted on sticks, as puppets, pupils may present a play to other members of their group to show what happens when light of the sun is blocked.

Let pupils make shadow pictures with their hands, using a projector light and screen. This could be done after the motion picture - "Shadows on Our Turning Earth."

Put metal articles in sun and shade and compare the warmth.

Use a magnifying glass to set fire to paper with the heat of the sun.

Show how sun helps evaporation by watching how puddles on the playground disappear in a certain length of time.

Wet a paper towel. Lay it in the sun. Place another in the shade. Have pupils notice which dries faster.

Ask children to watch water being sprayed as the sun shines on it.

Use a glass prism in the classroom and let pupils name all the colors they can see as the sun shines on it. Compare this to colors they see in rainbow. Draw pictures showing a rainbow. This is a good art lesson as the pupils enjoy mixing colors. Example: blue next to yellow to get green.

At Home-

Ask pupils to cover a small area of grass with a board or some other object. Leave covered for several days. Tell what happened to the grass.

At School-

Place one plant in the sun and another in a place which can get no sun. Water and see the difference in the plants after a period of two weeks.

PROBLEMS AND CONCEPTS	RESOURCES
MOON	
A. The moon is a satellite.	Branley, A Book of Satellites for You
B. The moon travels around the earth. Man-made moons (satellites sent up by rockets) circle the earth.	Podendorf, Space Lewellen, The True Book of Moon, Sun and Stars Mae and Ira Freeman, You Will Go to the Moon Hurst, The Big Book of Space Watts, The First Book of Space Travel
C. The moon gets its light from the sun. We don't see the sun - only the sun's light reflected by the moon. The sun shines on the moon all the time. We see only that part of the moon lighted by the sun.	Parker, Golden Book of Science Heath, Science for Here and Now, (Teacher's Manual) Wyler, The Sky Branley, The Sun, Our Nearest Star Branley, A Book of Satellites for You
D. The lighted part of the moon changes in shape.	Lewellen, The True Book of Moon, Sun and Stars Freeman, Fun With Astronomy L. W. Singer Co., Seeing New Things Winston, The New Seeing Why
	Model: "Moon Ball" or other ball
E. Shadows on the moon are made by mountains on the moon.	Filmstrips: "Moon, Sun & Stars" "Bob Visits the Moon"
	Newspapers: Current articles about space capsules made for landing on the moon. Example: Ranger VI.

ACTIVITIES

Using a globe in the center of a darkened room for the earth, let children sit or stand around it. A flashlight or projector can represent the sun and a ball with one side can be the moon. Let a child, holding the moon ball with the marked side facing the earth, carry the ball around the earth. Keep the light shining on the moon so children can see the light changes that take place on the moon.

Shine a flashlight or other light on a white ball to show how the moon gets its light from the sun.

Observe moon when it can be seen in the sky during the day.

Children look at and draw shape of the moon each day and compare changes.

Exhibit a series of pictures showing moon changes. Pupils select the one that shows how the moon looked at a particular time. If possible, use a telescope, field glasses or binoculars for this activity.

Put some clay mountains on the mountains on the moon ball. Notice shadows from the mountains when the moon ball is lighted by a flashlight or projector.

Show pictures of moon's surface.

PROBLEMS AND CONCEPTS	RESOURCES
STARS	
A. Stars furnish their own light. They shine all the time.	Parker, The Golden Book of Science Wyler and Ames, The Golden Book of Astronomy Wyler, The Sky Lewellen, The True Book of Moon, Sun and Stars Engelbrektson, The Sun Is a Star
B. Stars are visible on a clear night.	Filmstrips: "Finding Out About the Sky"
C. The stars are very large yet they look small because they are so far away.	
D. Some stars make patterns in the sky.	Branley, The Big Dipper

ACTIVITIES

Turn on lights in the schoolroom on a bright day. Turn on lights in a darkened room on the same day so pupils can compare brightness of the light. This will help pupils to understand that we cannot see the stars in the daytime because of the brightness of the sun.

Ask pupils to observe the stars on a clear night. Then ask pupils to observe them on a cloudy night.

Discuss how various objects look smaller at a distance. If possible watch a piece of paper as it sails through the air and discuss the smaller appearance it seemingly has as it gets farther away.

Hold a small flat object such as a coin directly in front of the eye of a child or allow him to do this. Then, as it is carried farther away from the eye by another pupil, let pupil tell how it looks.

Some stars make patterns in the sky as they appear to be located near other stars. Show a picture of the Big Dipper and the Little Dipper. Have pupils observe these two groups of stars at night and draw the pattern to bring to school. Compare with others to see if they all found the correct stars.

Pupils find the North Star (with the help of an adult). Discuss with them the fact that because it appears to stay in the same place, it is important and helpful in finding directions.

CHILDREN'S BOOKS

What Makes Day and Night - Branley

The Sun Is a Star - Englebrektson

The True Book of Moon, Sun and Stars - Lewellen

The Big Dipper - Crowell

The Sun: Our Nearest Star - Branley

Thinking About Science - Lyons and Carnahan

Science Around You - Craig and Daniels

Science Is Learning - Scott, Foresman

The New Seeing Why - Winston

Around the Corner - Rand McNally and Co.

Exploring Science (Two) - Allyn and Bacon

Seeing New Things - L. W. Singer and Co.

Science For Here and Now - Heath

Just For Fun - "The Story of Ibbity" - Lyons and Carnahan

You Will Go to the Moon - Mae and Ira Freeman

The True Book of Seasons - Podendorf

What Makes a Shadow - Crowell

TEACHERS BOOKS

Space - Podendorf

A Book to Begin on Outer Space - Holt

The Big Book of Space - Hurst

The First Book of Space Travel - Watts

The Sun - Zim

Golden Book of Science - Parker

The Golden Book of Astronomy - Wyler and Ames

Science for Here and Now - Heath

The True Book of Sun, Moon and Stars - Lewellen

The Sky - Wyler

The Big Dipper - Crowell

What Makes Day and Night - Branley

The Sun Is a Star - Englebrektson

The Sun Our Nearest Star - Branley

A Book of Moon Rockets for You - Branley

A Book of Satellites for You - Branley

A Book of Planets for You - Branley

Thinking About Science - Lyons and Carnahan

Science Around You - Craig and Daniels

Science Is Learning - Scott, Foresman

The New Seeing Why - Winston

Around the Corner - Rand McNally and Co.

Exploring Science (Two) - Allyn and Bacon

Seeing New Things - L. W. Singer Co.

You Among the Stars - Herman and Nina Schneider

What the Moon Is Like - Branley

A Child's Book of Stars - Barlowe

Fun with Astronomy - Freeman

Junior Science Book of Stars - Crosby

Picture Book of Astronomy - Meyer

HLC:rk

SCIENCE GUIDE

Unit Light

Grade Two

Fresno County Schools

HAROLD L. COLES, Superintendent

September, 1964

VOCABULARY

black
camera
eye
glasses
iris
lens
light
magnifying glass
mirror
moon
prism
pupil
reflect
rainbow
shadow
spectrum
star
sun
white

APPARATUS, EQUIPMENT AND SUPPLIES

binoculars
Braille, sample of
bubble pipes or straws and soapy water
camera
color paddles (three)
eye model
eye testing equipment (as used in school)
flashlight
glasses the children can investigate
globe
kaleidoscope
lens from an old pair of glasses
magnifying glass
mirrors
person wearing contact lens
prism
projector

INTRODUCING THE UNIT

In this unit are listed many activities to develop the three major concepts of light as listed in the second grade course of study. These concepts are: (1) LIGHT COMES FROM MANY SOURCES, (2) LIGHT ENABLES US TO SEE, and (3) A SHADOW IS A DARK PLACE MADE WHEN SOMETHING BLOCKS THE LIGHT.

Any teacher using this unit would want to select the activities that would fit her individual class. Some classes would be capable of using all the experiments, but time would not allow it for most. Art could be correlated in many ways, depending on the creativity of the particular class and teacher.

A natural follow-up for this unit would be a health unit on EYES AND VISION.

PROBLEMS AND CONCEPTS

Light Comes from Many Sources.

1. Light shines out of things that are very hot.
2. Through the years people have used camp fires, fire brands, candles, oil lamps, gas lights, and now electricity to see by when the sun is not shining.
3. The sun is a star, the closest to our earth, and makes our brightest light.
4. The moon and other planets reflect light from the sun instead of making their own light.
5. Some things can be seen because they give off light of their own, while others can be seen because they reflect light.
6. Objects with smooth, shiny surfaces, such as mirrors, are good reflectors of light.

RESOURCES

Children:

Knowing About Science, pp. 111-119

Exploring Science II, pp. 77-90

Light and Color, whole book

Lights, whole book

Finding Answers, pp. 101-108

Looking at Science, pp. 3-24

Science Everywhere, pp. 120-133

Teacher:

The Adventure of Light (Read to children)

The Secret of Light

Heat and Light

Audio-Visual:

Moving Pictures:

"Light for Beginners"

"Heat and Light"

"Light and What It Does"

Filmstrips:

"Bouncing and Bending Light"

"Light, Heat and Sound"

ACTIVITIES

Observation of light shining from hot things: the sun, a candle, lantern, flashlight, burning matches.

Experiment to answer the question: "Where does the sun go at night?" Stick a little clay man on the globe to show where we live. Place a light in the center of a circle drawn on the floor. Have a child walk around the circle, holding the globe and turning it as he walks. The children may discuss their observations and relate them to our earth's travels around the sun.

Experiment to answer the question: "Why does the moon shine?" Darken the room and have someone shine a flashlight on a ball, the flashlight representing the sun and the ball, the moon. Observe which part of the ball is lighted and discuss why. (The tentative conclusion: Moonlight is reflected sunlight and the moon has no light of its own.)

Experiment to answer the questions: "When can sun burn paper? Why does it do it?" Focus the sun into a bright spot on a piece of paper using a magnifying glass. Do it in a safe place and explain why. Fill a bottle with water and set in sun. Let the children feel the shape of the glass so they will understand how the light rays are bent and brought together to start the fire. Talk about forest fires started by bottles left on the ground. Heat and light are forms of energy.

Experiment to see what makes reflections. Assemble such things as a mirror, a piece of shiny metal, an aluminum pan, white paper, silver paper, etc. Look at objects in the sun, then move into the shade. Compare.

Bounce a ball off a wall to show how light reflects from objects.

Experiment to find out: "What can we do with mirrors?"

(a) Hold a mirror in the sunlight so it makes a spot on the wall. Move the mirror and see what happens to the spot.

(b) Put a mirror in front and one in back of you. Can you see the back of your head?

(c) How can you see behind a wall? Put a mirror in the doorway.

(d) Hold a mirror so you can see what is behind you; take the second mirror. Work with a friend. Your friend holds his mirror in the sunlight to make a spot. Have him put the spot on your mirror. Can you reflect the spot onto the wall? Can someone catch your spot on a third mirror and make a reflection of it?

(e) Put two mirrors together in the corner of a box. Put a little toy between the mirrors. How many toys do you see?

(f) Put a mirror in each end of a box. Cut a little hole above one mirror. Put a little doll in the middle of the box. How many dolls do you see when you look in the hole?

PROBLEMS AND CONCEPTS	RESOURCES
What Makes a Rainbow?	
1. Rainbows are made by tiny drops of water in the air that act like prisms to break the white sunlight into the colors of the spectrum.	Listed on preceding page.
2. The spectrum of colors in white light can be seen by passing it through a prism.	
3. There are many colors in white light or a beam of sunlight.	

(g) Tape three mirrors together to make a kaleidoscope.

Discuss: "How do people use mirrors?" (dentists, rear view mirrors in cars, periscopes on submarines, reflecting telescopes, to see oneself)

Use mirror to reflect picture from either slide or movie projector on ceilings.

Observe, then draw a rainbow.

Experiment to find out: "What makes a rainbow?"

(a) Put a small mirror in a glass of water. Put it on a slant. Put the glass where the sun can shine on the mirror. Look at the colors on the wall or ceiling. Discuss where they came from and what made the colors separate.

(b) Put a water sprinkler in the sun. Stand behind the sprinkler so the sun is shining from in back of you. Turn on the water. Observe the rainbow made by the sun shining on the drops of water. Discuss the fact that the water does not reflect all of the light as does a pool of water. When rays of light strike drops of water, they are not reflected but are broken up into violet, indigo, blue, green, yellow, orange and red. When you see a rainbow in the sky rays of sunlight are striking drops of water.

(c) Hold a prism in front of your eyes and look out the window through it. Put a piece of white paper on the table or floor and let the rainbow from the prism fall on the paper. Observe the colors that can be seen. Discuss similarity between drops of water and prisms in being able to break up white light into the colors of which it is made.

Experiment to find the answer to the question: "What color is sunlight?" Darken the room but allow a ray of sunlight to enter. Hold a prism in the ray of sunlight. Rotate the prism until a band of colors shows on the wall. Hold the prism steady and notice the colors. (The colors are red, orange, yellow, green, blue, indigo, and violet, in that order.)

Blow bubbles with soapy water and straws or bubble pipes. You might also use a commercial bubble mixture and wire ring. Look for rainbow colors in the bubbles. Talk about "why?"

Make tops with a circle of cardboard and a pointed stick. Color with primary colors. Spin tops and watch the colors change. Discuss what happens to the colors--which colors are seen for the longest time, which color disappears and which colors blend to make new colors.

Mix paint to experiment with making colors using tempera.

Experiment to find the answer to the question: "Why is the sky blue if the sunlight is white?" Put a few drops of milk in a glass full of water. Darken the room, then hold a flashlight two inches from the

PROBLEMS AND CONCEPTS	RESOURCES
Light Enables Us to See.	
1. Our eyes see light. There could be no sight without light.	Your Eyes (Could be read to children or read by a very good 2nd grader)
2. Some objects can be seen because they give off light of their own, others, because they reflect light.	Look at Your Eyes (Excellent for children)
3. The pupil lets light into your eye, its size adjusting to the amount of light your eye needs.	Why Glasses? (Teacher could read parts of this to children)
4. Your eye works the way a camera does.	Teaching About Vision (teacher)
5. Your brain tells you what your eyes see.	Teaching About Light and Sight (teacher)
6. The eye can be hurt by too much light, by a hard blow, or by flying bits of dust or metal.	Moving Pictures: "Eyes Bright"
7. You can find out about distances and shapes by what you see.	"Our Senses: What They Do For Us"
8. You can tell solid from flat objects because each of your eyes sees a different picture and your brain forms it into one picture that has depth.	"Our Wonderful Eyes and Their Care" "You and Your Eyes

glass and at a right angle to it. Observe the blue color of the water. Discuss the reason why. (The few drops of milk in the water, representing the dust in the air, have scattered the blue rays in the white light from the flashlight, the same as the dust and moisture in the air bend and scatter the blue rays from the sun.)

Experiment with flashlight to find out what things light will go through. Let children think of things to use.

Make three paddle-like structures with primary colors (red, yellow and blue) of cellophane in the center. Look through them at things in the room. Shine a flashlight through them. See what colors you can make.

Use the above equipment or a commercial spotlight and colored gelatins to show stage lighting effects. (Show how certain colors of light can make colors on costumes seem to disappear.)

Experiment to find out: "What happens when light shines into water." Put a pencil in a half full glass of water. Look at the pencil from above the glass, then hold the glass up and look through the side of the glass. Next put the glass on the table and look at it from about a foot away facing it and looking part way into the glass. Discuss the fact that water acts like a lens. Lenses are curved to bend light waves. This is called refraction.

Observe lenses from a flashlight, a magnifying glass and the eyeglasses of a student. Discuss how glasses correct poor vision.

Take a box type camera apart. Have the children find where the light enters the camera, where the lens is, and discuss how the picture is focused on the film. Compare a person's eye with the camera.

Look at a model of an eye. Compare with a camera.

Experiment: Watch the pupil of your eye grow smaller. Close your eyes almost all the way. Count to 10. Open your eyes wide. Watch one pupil in the mirror. When your eye needs a lot of light the pupil gets big and when it needs a small amount it gets little. The pupil is a little round window that lets light into your eye.

Observe the eyelids. (They keep out the light so you can go to sleep. They also protect the eye from dust, etc.)

Discuss tears. "Do you have to cry to make tears? Are tears good or bad for your eyes? What do they do?"

Turn the light on and off. Discuss how quickly the room lights up. Discuss the speed of light. (Light travels 186,000 miles a second and in straight lines through air, water, glass, and other substances. When light waves bounce off an object they travel in straight lines in all directions. There are special structures in the eye that bend or refract light rays when they hit the eye. They come together in the back of the eye and form a sharp image or picture on the retina.)

PROBLEMS AND CONCEPTS

9. Most people with glasses wear them because they are nearsighted or farsighted.

10. Lenses bend light.

11. Light travels faster than any other known thing and always at the same rate of speed. (For gifted students this concept could be enlarged upon as the basis for later understandings in science.)

12. Light travels in straight lines, but under certain conditions it will bend, as when it passes from air to water.

A Shadow Is a Dark Place Made When Something Blocks the Light.

1. We can see the earth's shadow when it falls on the moon. This is called an eclipse of the moon.

2. You can measure the heights of trees and buildings by comparing their shadows with the shadow of a stick whose length you can measure.

3. Shadows not only change in length, but they also turn as the earth spins on its axis.

4. Shadows help us tell the shape of things.

5. When you take a picture with your camera, light and shadows make the picture for you.

6. Green plants can be shaded out until they die because they need light in order to live.

7. X-ray pictures can be taken because the bone casts a shadow on the film. A cavity in a tooth does the same thing.

RESOURCES

Filmstrips:

Series--"Light and Eyes"

1. "How Light Helps Us"
2. "How Our Eyes See"

"Bonnie, the Seeing Eye Dog"

Shadows The whole book could be read to the class and good readers could read it again on their own.

Moving Pictures:

"Shadows on Our Turning Earth"

"Big Sun and Our Earth"

ACTIVITIES

Have a person wearing contact lenses visit the class. Have him demonstrate how he puts them in place and explain why he wears them rather than regular glasses.

Take the children on a trip to an optometrist's or oculist's office.

Have an eye doctor visit and speak to the class if a trip is not possible. (Get the school nurse to come if no doctor is available.)

Discuss blind people and their problems. Let children feel a sample of Braille.

Play shadow tag at different times of the day. Observe the difference in length of the shadows at different hours. Discuss why this is so.

Experiment to see how much shadows change in length. Put marks or pegs in the ground at regular intervals to measure the length of the shadow of a post on the school grounds. (A crude sundial could be made by this experiment if a peg were put at the end of the shadow each hour.)

You can measure the height of a tree by measuring the length of its shadow. First find a stick whose height you can measure with a ruler. Then measure the length of its shadow. When the shadow is twice the length of the stick, then the same will be true of the tree and its shadow so you will be able to figure out the height of the tree.

Make a sundial. The earliest type of sundial was made by the Egyptians 3,500 years ago. It was made of a ruled bar pointing east and west and a crosspiece mounted at one end and pointing north and south. The shadow of the crosspiece became shorter as the sun climbed higher. The length of the shadow showed the time of day on the ruled bar.

Another type of sundial is the following: Nail a stick to a board so that it stands up straight. Draw a circle on the board around the stick and divide it into 24 equal spaces. Then turn and tilt the board until the stick points to the place in the sky where the North Star is at night. In the daytime the shadow of the stick will turn on the board the way the shadow of a vertical stick would if it were stuck in the snow at the North Pole.

Experiment to find out: "What makes a shadow?" Make the room dark. Turn on the projector and put it on the wall or screen. Hold various things one at a time in front of the projector. Observe what happens when you hold up a solid object, a piece of glass, colors of cellophane paper.

Experiment to find out how a plant can get "shaded out" as do the birches in a fir forest. Keep a bean plant in the light and another one in the dark. Observe the health of both plants and compare.

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Audio-Visual Materials:

Moving Pictures:

"Eyes Bright"

"Our Senses: What They Do For Us"

"Our Wonderful Eyes and Their Care"

"You and Your Eyes" (Jiminy Cricket explains structure and anatomy of eye)

"Light and What It Does"
(How light travels; how it is affected by different materials; what causes reflection and refraction; and how light is used in many everyday activities.)

"Light for Beginners"

"Heat and Light"

Filmstrips:

"Light, Heat, and Sound"; Science for Beginners

"How Light Helps Us"

"Bouncing and Bending Light"

"How Our Eyes See"

"Bonnie, the Seeing-Eye Dog"

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